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Real Change, At Scale.

THE PROMISING CLIMATE SOLUTION THAT NO ONE IS TALKING ABOUT: WASTE AND ITS ROLE IN CLIMATE CHANGE

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A once pristine beach littered with waste. An open garbage dump spewing smoke into the air. People packed in cities sweating through yet another heatwave. These issues around waste and climate change might seem like different sides of an environmental crisis, but the reality is that they're intertwined. Waste creates significant emissions and environmental concerns due to issues like methane gas escaping from landfills, open burning creating unhealthy fumes, and plastic wreaking havoc on ocean ecosystems. Improving waste management with an eye towards minimizing emissions can significantly address our multi-faceted waste crisis.

In this article, we'll examine:

- The scale of waste's climate impact
- How different waste management practices contribute to climate change
- How to mitigate the climate impact of waste — including three concrete steps governments can take

THE SCALE OF WASTE'S ENVIRONMENTAL IMPACT

All the food scraps, plastic trash, and other mixed waste in the world adds up to big a problem for the planet.

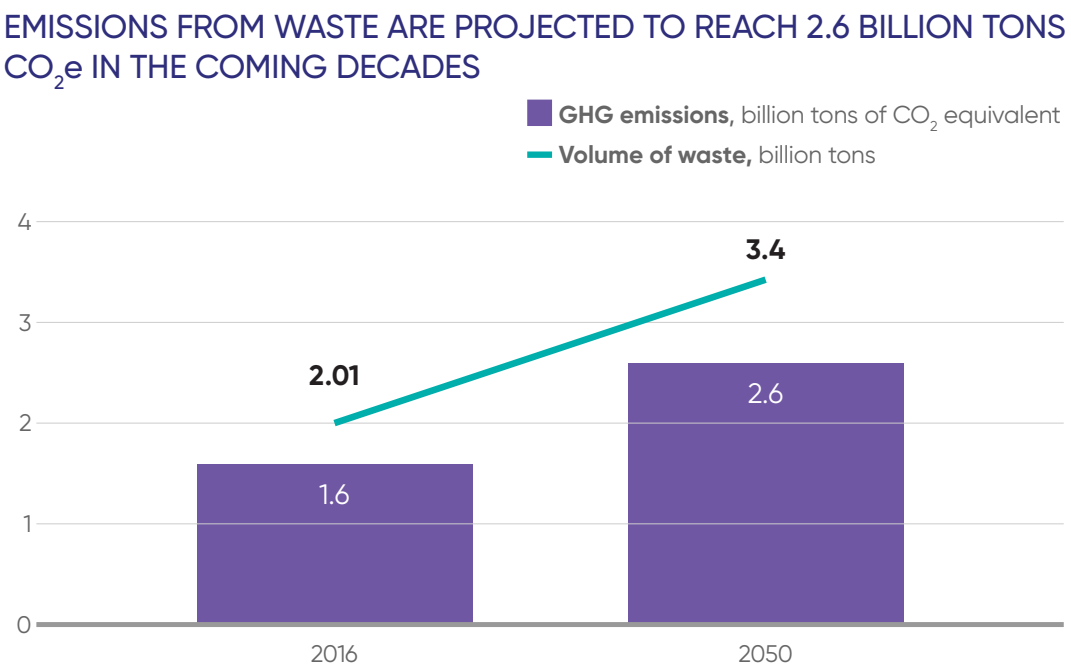

Exhibit 1. Emissions from waste are projected to reach 2.6 billion tons CO_2e in the coming decades.[1,2]

According to the IPCC reporting, waste already accounts for 3.9% of emissions globally. Meanwhile, in some cities in the Global South, waste today accounts for a larger source of overall emissions (e.g. 13.8% in Buenos Aires, Argentina[3] and 38.5% in Accra, Ghana[4]). Some environmental groups, however, contend that the global climate impact of waste is much greater, due to accounting and estimation methodologies and data inconsistencies.[5]

Plastics, specifically, represent a unique threat to the climate, as plastic use and waste is expected to triple by 2060, contributing to climate change as well as other environmental issues. Based on current disposal habits, **the full life cycle of plastic could contribute up to 15% of global GHG emissions by 2050.[6]**

HOW DO DIFFERENT WASTE MANAGEMENT PRACTICES CONTRIBUTE TO CLIMATE CHANGE?

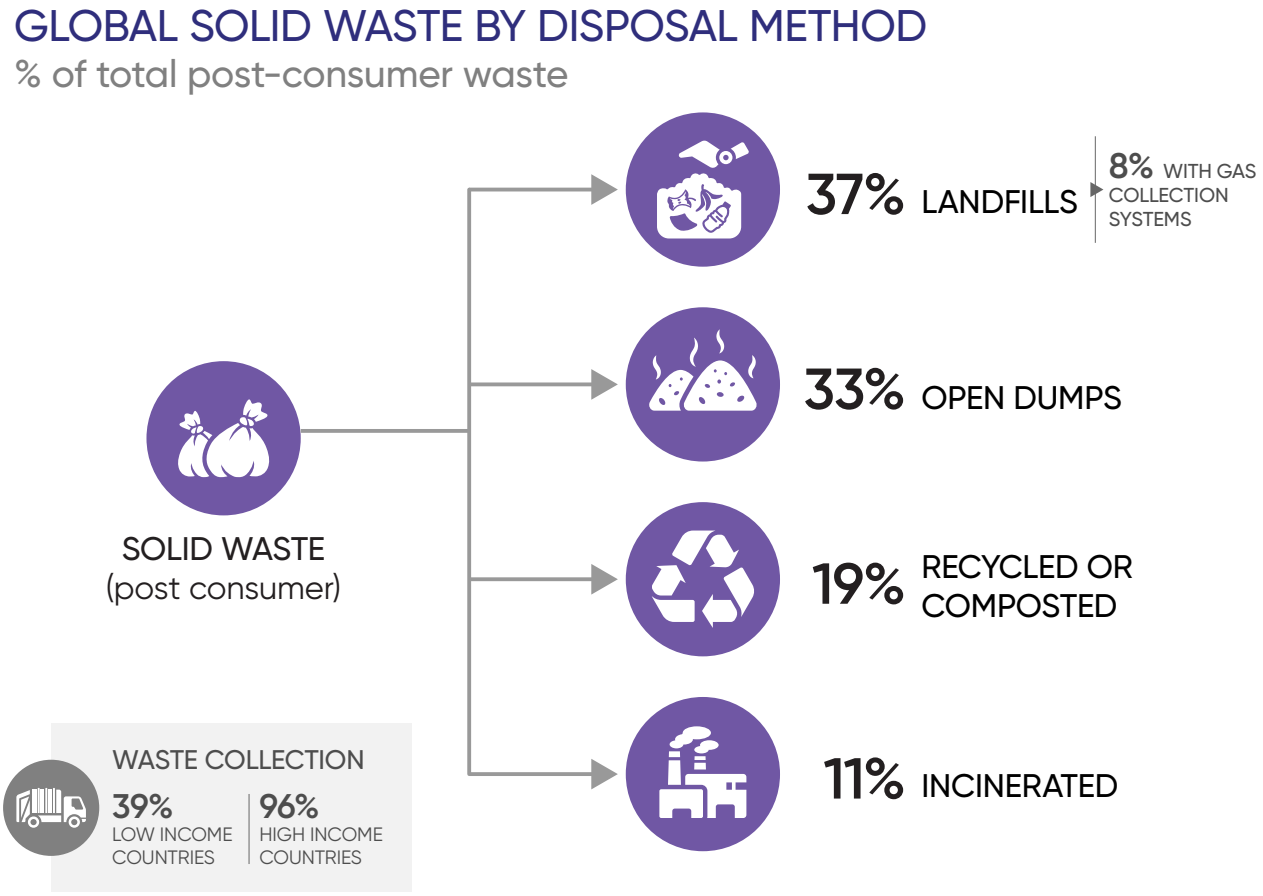

Exhibit 2. A significant amount of waste ends up in landfills or open dumps.[7]

Waste doesn't just take up space in landfills. It also creates significant GHG emissions that warm the planet. Most of the GHG emissions from the waste sector are driven primarily by disposing of waste in open dumps and landfills without landfill gas collection systems, which generate methane that leaks into the atmosphere. Open dumping frequently goes hand in hand with open burning, a practice with significant climate impact, as it releases black carbon, which has a global warming potential up to 5,000 times greater than carbon dioxide and could be contributing to as much as 10% of global GHG emissions.[8] Studies have shown that transitioning to semi-aerobic landfill disposal methods (i.e., decomposition in the presence of oxygen), could help reduce emissions from open dumping and associated open burning by 40%.[9]

COULD MANAGED LANDFILLS SOLVE THE PROBLEM?

Modern sanitary landfills are highly engineered facilities that, once filled with trash, are sealed to minimize contact with the surrounding environment. Inside the cell, the trash is packed down tightly, squeezing out all the oxygen. This means that the organic portion of the trash (e.g., food waste or yard trimmings) decomposes anaerobically, producing methane, a potent GHG.[10] **So, while sanitary landfills avoid many environmental issues and minimize the likelihood of open burning, they are not a true solution to tackling methane emissions and might even be creating the conditions for greater warming if gasses are not captured.**

WHAT ABOUT LANDFILL GAS CAPTURE PROJECTS?

A portion of existing landfills are equipped with gas collection systems that allow for this gas to be used as a source of energy. However, these capture mechanisms can only be put in place as each section of the landfill is covered and sealed. By that time, the landfill would have already released a significant portion of the total potential methane emissions, rendering the sealing and capture process less effective overall. Once in place, gas capture projects can achieve up to ~80% capture rate, but the emissions prior to the sealing process remain a problem.[11] **The use of landfill gas capture mechanisms is a pathway to progress in the right direction, but alternative solutions provide more effective paths towards decreasing greenhouse gas emissions.**

COULD WASTE BE BURNED IN A MORE CONTROLLED MANNER?

Incinerating waste may seem like a way to permanently get rid of it. However, burning trash transforms it from a solid to a gas, and creates potentially toxic ash that must later be landfilled. Although incineration processes are understood to have a lower climate impact than landfilling, the exact emissions potential varies based on composition of the waste inputs. When the material is mostly made up of carbon (like plastic), the released gas will contain CO_2, which contributes to global warming. Additionally, if an energy source that has a significant GHG footprint is used for the incineration process, some of the climate benefits may be lost.[12]

On the other hand, burning waste also releases energy. In a "waste-to-energy" or WTE plant, this energy can be used to make electricity, replacing some electricity that normally comes from fossil fuels like coal and natural gas. Given the variance in GHG footprint and concerns about other environmental impacts, questions remain on whether incineration is the right solution for many parts of the world.[13]

WOULD RECYCLING HELP?

Recycling most materials generally lowers emissions of CO_2 compared to other methods of disposal, with some variation based on processing specifics.[14,15] However, in most cases, it does not eliminate emissions completely, as there are still emissions generated from transportation, power for materials sorting facilities, and recycling process emissions. However, it does help avoid emissions from producing and using virgin materials earlier in the value chain. Based on today's material consumption across the world, support for and expansion of recycling is necessary to combat further climate impact.

IS COMPOSTING BETTER THAN LANDFILLING?

Composting is an aerobic process that requires oxygen for microbes to break down biodegradable materials (versus anaerobic processes that do not use oxygen). Aerobic processing of organic materials releases carbon dioxide and methane, but a significantly lower quantity of methane than the anaerobic processes that take place in landfills. Given that methane is a much more intense greenhouse gas, with a warming potential of 30+ times larger than CO_2, **switching from landfilling to composting of organic waste leads to an exponential decrease in climate impact.[16,17,18,19] This emissions avoidance opportunity is even more significant considering that, on average, 44% of global waste can be composted.[20]** Based on the tools and disposal methods available today, composting is the most promising climate solution for organic waste.

HOW CAN BETTER WASTE MANAGEMENT ACCELERATE OUR TRANSITION TO CIRCULAR ECONOMY AND MITIGATE SOME OF THE CLIMATE IMPACT?

TOGETHER WITH OTHER ENVIRONMENTAL SOLUTIONS, BETTER WASTE MANAGEMENT IS ESSENTIAL TO COMBATING CLIMATE CHANGE.

The best way to reduce GHGs would be to avoid creating them in the first place, by eliminating and reducing unnecessary packaging and products. However, we have already created an enormous amount of waste, and that is only projected to grow. **Recycling will continue to be part of the solution, as it has the largest impact on minimizing GHG emissions from non-compostable waste.**

From a lifecycle analysis perspective, recycling creates ripple effects throughout material value chains. In the case of paper, production of products includes many emissions-generating steps before reaching the end consumer. In a circular value chain, the recycled paper would re-enter the production process mid-chain, and therefore avoid emissions from upstream activities as well as those downstream from landfilling or incineration.

GREENHOUSE GAS EMISSIONS THROUGHOUT THE LIFECYCLE OF PAPER

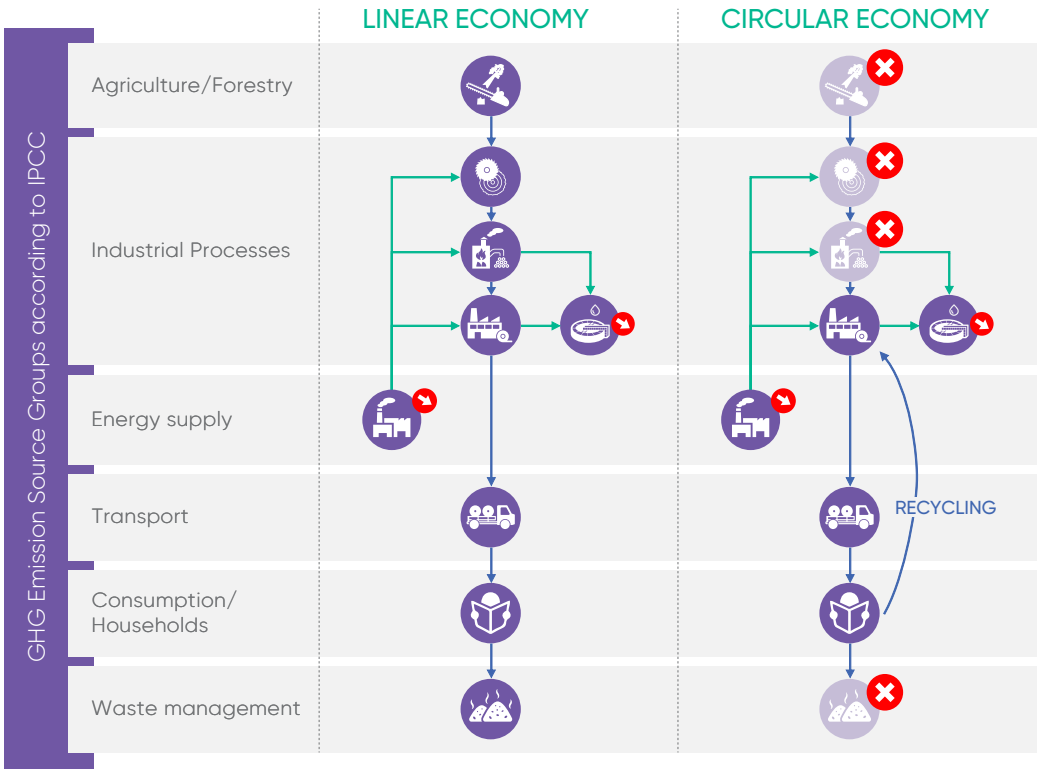

Exhibit 3. Recycling helps avoid GHG emissions in the beginning and the end of materials.[21]

WHAT IMPACT COULD RECYCLING REALISTICALLY HAVE?

Across the world, recycling rates today vary significantly, with European countries typically leading the way. Germany, for example, boasts the highest municipal waste recycling rate today of about 70%.[22] The success seen in Germany suggests that there is a pathway for other countries to follow suit, which would likely cause a dramatic reduction in waste related GHG emissions. **If this level of advanced solid waste management can be actualized, estimates suggest that global GHG emissions could decrease by 15-20%.[23] This would be equivalent to eliminating more emissions than the entire transportation sector globally or eliminating the entire emissions of the US.[24]**

If further circular economy concepts such as waste elimination, product reuse, and materials recirculation are put into practice, analysis by the Ellen MacArthur Foundation suggests that the impact could be even larger. In the case of steel, aluminium, plastics, and cement industries, **adherence to these circular economy practices could decrease the total GHG impact by 40%.[25]**

Environmental Impact: Not only can better waste management practices reduce GHG emissions, but they can also improve quality of life and public health through cleaner air, prevent water and soil contamination, conserve natural resources and in some cases provide a source of energy. Reduction of open burning, for instance, will directly impact the air quality in surrounding areas, an environmental factor that can have long term effects on residents' health and is known to particularly harm more marginalized groups.[26]

WOULD IT MAKE SENSE ECONOMICALLY?

Focusing on waste management also makes financial sense for governments. Established markets for recovered aluminum, paper, cardboard, and plastic allow for recovered materials to be leveraged as a revenue stream, thereby subsidizing the entire waste management system. Furthermore, development of more nascent markets such as flexible plastics or organics will enable additional investment for end-of-life management of these materials.

There is also a financial case for combatting methane emissions through improved waste management of organics and other landfilled waste. According to a 2021 UNEP and Climate & Clean Air Coalition report, preventing one metric ton of methane emissions from waste costs substantially less on average than mitigating methane from oil and gas production or agriculture, and often saves money by avoiding landfilling costs.[27, 28]

The bottom line: The waste sector is a huge opportunity to decrease GHG emissions in an economic way, while driving environmental and societal value for governments and municipalities.

HOW CAN WE CAPTURE THIS OPPORTUNITY?

To tap into the climate benefits of better waste management, local governments can deploy three synergistic, systemic solutions:

#1 | EXPAND WASTE MANAGEMENT INFRASTRUCTURE

To ensure that materials are disposed of through the optimal pathway to minimize climate impact, there must be sufficient infrastructure in place for material collection, sortation, and treatment, as well as smaller scale infrastructure to enable for households to use best practices for waste disposal. Investment in household infrastructure (e.g., bins, cans, etc.) can help preserve the value of different types of waste at the source. Further up the value chain, investment in recycling operations (e.g., sortation facilities) and composting centers will enable further diversion of waste out of landfills to lower-emissions alternatives. In the cases where landfill diversion is not feasible, technological advancements in areas like landfill gas recovery can help minimize emissions escaping into the atmosphere.[29]

#2 | ENSURE FUNDING FOR OPERATIONAL COSTS OF WASTE MANAGEMENT SYSTEM

Aside from covering capital costs, steady funding for operational expenses (~55-80% of total waste management system costs[30,31]), can help provide consistency in waste handling practices and spur process improvements, leading to GHG reduction. These operational expenditures include items such as ongoing community education, labor for material collection (e.g., formal waste management or informal waste workers), and workers to sort collected materials. Sufficient funds to support these expenditures are critical to creating stable systems that are seen as consistent and reliable by the community.

#3| INVEST IN BEHAVIOR CHANGE

The biggest barrier to expanding sustainable waste management today is the low value of processed organic waste. Organics comprise up to 44% of post-consumer waste by weight, and therefore most of the cost of collection, transport, and storage of waste overall.[32] The more these get separated, the easier it is to then maintain clean streams of valuable recyclable plastics, for example.

Within Delterra's research on behavior change, we found that promoting source separation through behavior change costs $50-150 for every additional ton of recyclables, as opposed to increasing sorting efforts, which costs $200-700 per additional ton.[33] Increasing diversion of organics and recyclables through community activation and education can help minimize methane produced from organics in landfills, as well as improve cleanliness of recyclables streams, leading to higher material offtake values.

From its inception, Delterra's Rethinking Recycling initiative has prioritized diverting organic waste, alongside plastics and other recyclables, back into productive use. We are committed to improving waste management systems in our partner communities to drive positive impact on the climate, as well as for the health and wellbeing of the communities we serve.

ENDNOTES

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10. "Where landfill practices are informal and do not extend to site compaction and cover, the optimum anaerobic conditions for methane-production do not develop. Therefore less methane is produced per tonne of organic waste (compared to controlled sites). Degradation processes proceed under more aerobic conditions, generating larger quantities of biogenic CO2." UNEP, Waste and Climate Change
11. https://pubmed.ncbi.nlm.nih.gov/16198554/
12. UNEP, Waste and Climate Change; https://wedocs.unep.org/handle/20.500.11822/8648
13. In some countries, incineration might be detrimental as it may encourage even more consumption due to large constant demand for waste. Prior evidence shows that these types of facilities are often not operated properly and harm nearby communities, and are, ultimately, more expensive to operate than low-tech sustainable waste management.
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