ReFED

Advancing Data-Driven Solutions to Fight Food Waste

How Food Waste Solutions Can Drive Methane Mitigation:

Understanding Philanthropy's Critical Role

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Summary

Slashing methane emissions is the single most powerful lever we have to limit the impacts of climate change on our communities and our ecosystems. Realizing this, a first-of-its-kind philanthropic alliance has been created to fund and deploy solutions with the goal of reducing methane emissions 30% by the year 2030.

Food waste is responsible for methane emissions through two pathways – landfills and livestock – and represents a critical opportunity to target methane, along with other greenhouse gasses, while providing diverse co-benefits spanning water conservation, protection of biodiversity, improved food security, improved local air quality, and more. Landfills are the third largest contributor to methane emissions in the United States, and food scraps are the highest volume input to landfills. Furthermore, livestock agriculture is *the* largest contributing sector to methane emissions, and reducing the amount of meat and dairy wasted could serve to reduce livestock-generated methane emissions.

As philanthropic organizations consider their portfolio of solutions to address methane emissions, it's imperative that food waste reduction programs are included. Investments in upstream food waste prevention and diversion address the problem of methane emissions at the source, delivering desired emissions reductions along the pathway of the entire food system, as well as offering substantial co-benefits.

Methane Emissions Reduction Needs to be a Priority

Under all emissions scenarios considered in the 2021 IPCC report, our planet is on track to breach the target of 1.5°C of warming by 2050. Deep reductions in greenhouse gas emissions are required on an urgent timeline to limit further warming and avoid the most harmful impacts to our communities and ecosystems.

Until recently, mainstream strategies to mitigate climate change were focused primarily on reducing carbon dioxide emissions.

At COP26, methane broke into the spotlight, and for good reason. Methane is our planet's second most abundant greenhouse gas. It is far more potent than carbon dioxide (20-year GWP of 80), but breaks down much more quickly in the atmosphere – on average after about 12 years. This means that efforts to cut methane concentrations right now would see cooling effects in that time frame – a promising opportunity to limit warming in the near term and meet 2050 climate goals.

25%

It's estimated that at least 25% of today's warming is attributable to methane emissions from human activity. The IPCC reports that methane concentrations have increased since 2007.

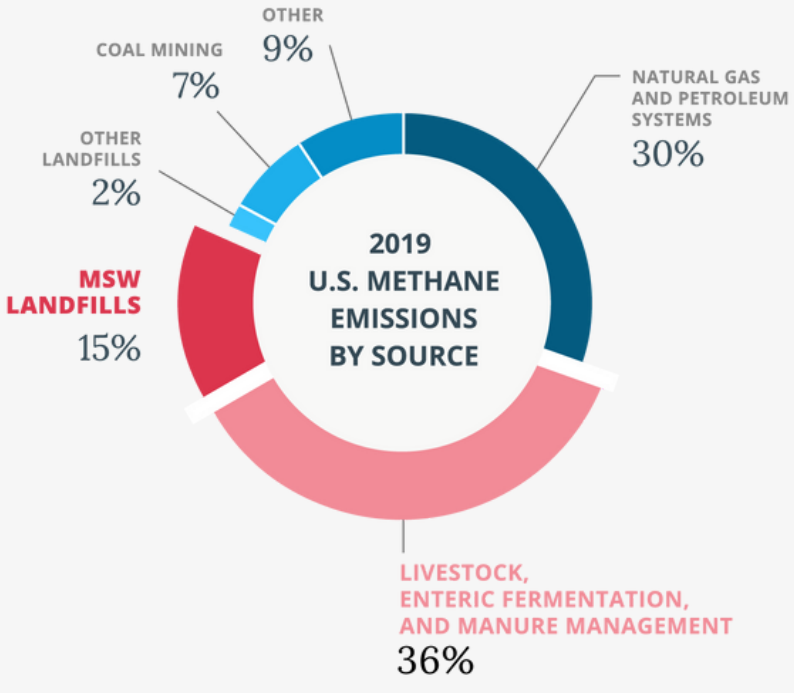
Slashing our methane emissions is the *single most powerful* lever we can pull to rapidly curb the effects of climate change and avoid escalating levels of devastation.

How are Methane and Food Waste Related?

LANDFILL

Municipal solid waste (MSW) landfills represent the third largest source of methane emissions in the United States, behind natural gas and petroleum systems and enteric fermentation. According to the EPA's official report, MSW landfills account for 15% of total methane emissions in the U.S. However, there is credible reason to believe that this figure is underreported by as much as a factor of two. Senior engineers within the EPA's own ranks have raised concerns about their methods for methane estimation modeling. Similar concerns have been voiced by watchdog groups like the Environmental Integrity Project.

If these concerns prove correct, MSW landfills could account for as much as 26% of U.S. methane emissions, virtually matching enteric emissions from livestock.



Source: EPA

LANDFILL

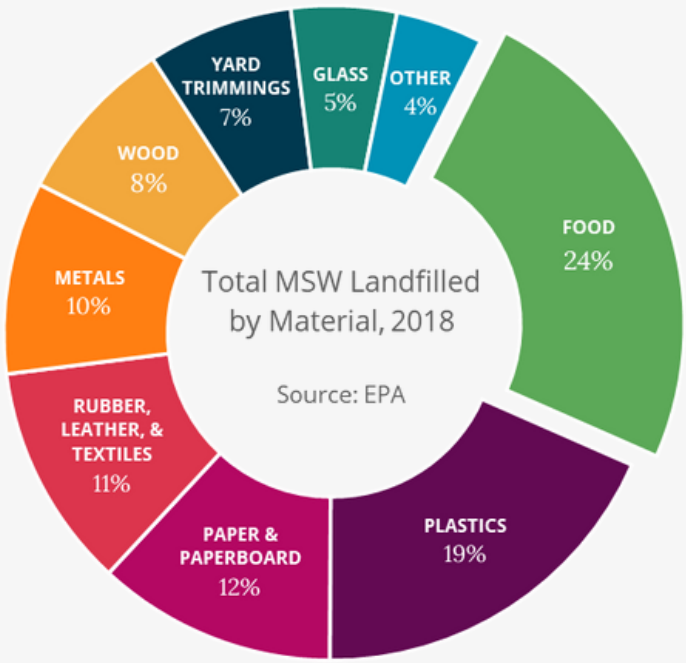
No. 1

Food waste is the number one contributor to landfills and is the driving force behind their contributions to methane emission totals.

In 2018, surplus food accounted for 24% of material sent to landfill. Significant volumes of waste occur at every point of our food system. Stakeholder groups ranging from manufacturers to end consumers all meaningfully contributed to the 27.6 million tons of surplus food that were sent to the landfill in 2019. This directly translates into 128 million tons of CO_2e emissions annually. A significant portion of these emissions derive from methane. As food waste decomposes, it produces landfill gas (LFG), which contains 45%-60% methane.

Landfill capping or gas capture systems are often proposed to limit methane emissions from landfills, but the timing of installation may not align with the timeline of methane generation, and significant leakage has been shown to persist even after installation. Because decomposition of organic material is what drives methane generation, a more direct way of reducing emissions is to simply divert food waste from landfill.

33% **An EPA study from 2019 suggested that food waste diversion would reduce methane generation potential by 33%.**

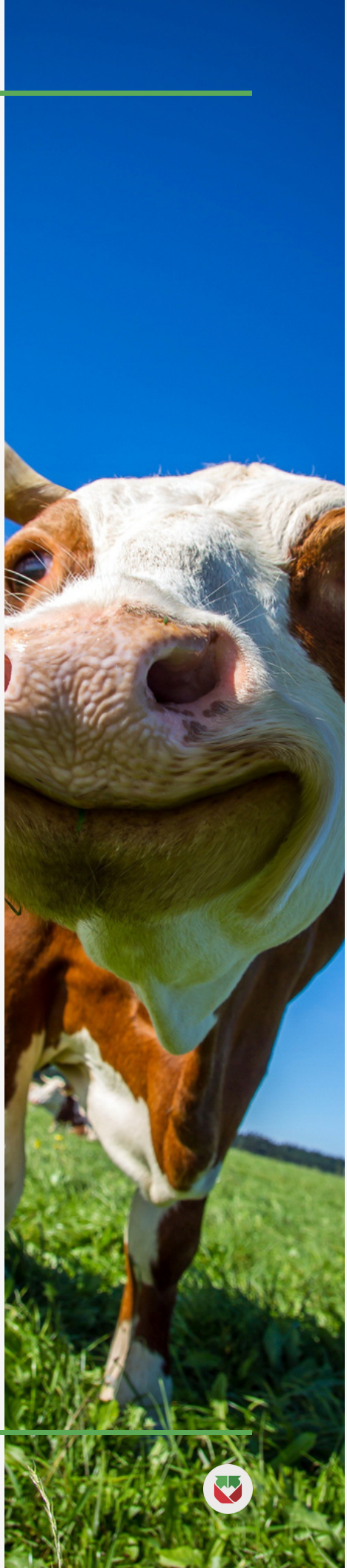


LIVESTOCK

Together, enteric fermentation and manure management made up 36% of US methane emissions in 2019, making agriculture (specifically, livestock production) the largest contributing sector. The digestive process of ruminant animals like cattle, sheep, and goats relies on gut microbes that produce methane, which alone contributes 27% of US methane emissions. Manure from livestock also generates methane as it decomposes anaerobically.

ReFED analysis indicates that about 12% of beef and 17% of dairy products go uneaten. This means that all the methane emissions associated with raising that livestock, not to mention the water resources, processing emissions, and emissions associated with the waste destinations, are for naught. Significant research and investment is being directed towards feedstocks that reduce methane generation and manure management best practices, but simply reducing waste of these products would ease demand. These interventions are not mutually exclusive, and indeed maximum mitigation potential can be achieved by tackling all emissions pathways in tandem.

17% **of dairy products and 12% of beef go uneaten.**



Potential Strategies to Mitigate Methane Emissions

Strategies to reduce methane emissions can be broadly categorized into three groups: Upstream Avoidance, Upstream Diversion, and Downstream Capture. Upstream Avoidance strategies are preferred, as they address methane emissions at the source and deliver numerous co-benefits. Upstream Diversion strategies don't address the source of the problem but are preferred to Downstream Capture strategies, as they retain more of food's value for society. Individual strategies within Upstream Avoidance, Upstream Diversion, and Downstream Capture have their own strengths and weaknesses. Given the magnitude, complexity, and urgency of this challenge, it's critical that we work quickly to understand all options on the table and strive to deploy resources effectively.

UPSTREAM AVOIDANCE

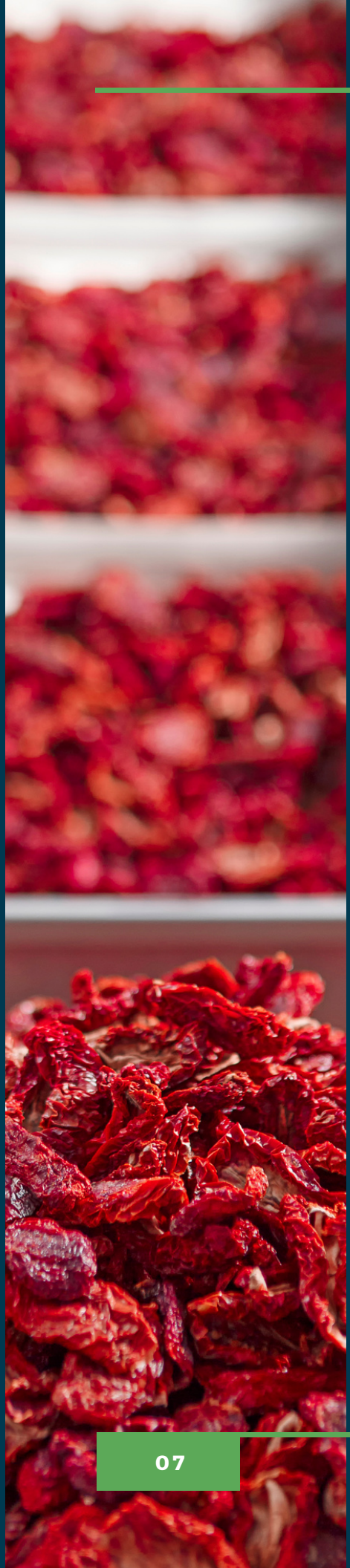
Food waste exists at every point in our food system, but there are numerous opportunities to address these inefficiencies at their points of occurrence. These Upstream Avoidance strategies keep food, and any associated methane emissions, applied to its best and highest use – being eaten by humans. ReFED has modeled 37 Upstream Avoidance solutions along the supply chain. These identified solutions fall into three categories: prevention, rescue, and higher-order recycling.

- **Prevention strategies** address the food waste problem at its root, ensuring waste never happens to begin with. Sample strategies entail helping manufacturers upcycle food into new products, leveraging technology to improve demand planning for retailers, and helping consumers form better habits. We project that prevention programs will be responsible for 87% of emissions reductions from reaching our goal of cutting food waste in half by 2030.

- **Rescue strategies** help power a more equitable future by providing meals to those in need, while ensuring surplus food doesn't make its way to landfill. Sample rescue strategies include educating donors about liability protections, scaling up the capacity of food banks, and using technology to improve coordination. ReFED estimates that investing in rescue strategies that help achieve our national goal could provide four billion meals for the one in eight people that are food insecure in the United States.

- **Higher-order recycling strategies** are the last resort among Upstream Avoidance strategies, but are preferable to both Upstream Diversion and Downstream Capture. Higher-order recycling involves converting surplus food to livestock feed, which keeps the value of the material within the food system. This can be excess food fed directly to livestock, or food scraps converted to livestock feed via processing or as a substrate to grow insects that ultimately become feed.

87% **of emissions reductions projected from cutting food waste in half come from prevention solutions.**



UPSTREAM DIVERSION

Once prevention and rescue strategies are no longer feasible, the objective pivots to salvaging as much residual value as possible from the food or food scraps that would otherwise be wasted.

ReFED has modeled five Upstream Diversion solutions. This solution set includes composting and anaerobic digestion. Composting breaks down the food waste and yields rich, nutrient-dense soil amendment that can be used as an agricultural input. In addition to recycling nutrients, using compost offsets the need for GHG-intensive synthetic fertilizers and increases soil's ability to sequester carbon. Anaerobic digestion involves capturing methane as surplus food decomposes, similar to the process that takes place in landfills. However, anaerobic digestion is about twice as efficient at capturing methane as LFG capture systems.

DOWNSTREAM CAPTURE

Once food waste has already been sent to landfill, upstream diversion is no longer possible. The only remaining solution is downstream capture. The Clean Air Act requires landfills of a certain size to install LFG collection and monitoring systems. These systems capture LFG and either flare the gas or convert it to biogas for energy. Flaring the gas turns the methane into carbon dioxide through combustion. While carbon dioxide is much less potent than methane, it is still a greenhouse gas that should be avoided if possible. There is a general consensus that conversion to biogas is preferable between these two downstream capture options, as it returns value in the form of energy, but it's not without drawbacks. Estimates vary widely, but it's generally acknowledged that a significant amount of leakage exists in the system. Much of the methane is produced, and likely escapes, before capture system installation is required. Beyond that, there can be leakage.

The EPA estimates that 60-90% of methane is captured by these systems, but this is contested by many, including the IPCC, which has stated the lifetime capture may be as low as 20%. Separately, there is a concern about heavily investing in infrastructure that relies on – and thus creates a perverse incentive for – a waste stream as its feedstock. For all of these reasons, preventing food from getting to the landfill is far preferred over managing the methane it produces once there, especially given the federal goal of cutting the food waste stream in half by 2030.

Philanthropy's Role in Cutting Methane Emissions

Philanthropy plays a critical role in de-risking solutions and scaling up the infrastructure required to curb methane emissions. It's heartening to see some of the most influential foundations in the world taking up this call. In total, more than $328 million have now been committed by philanthropic organizations in support of the Global Methane Pledge. This represents a first-of-its-kind opportunity to slash methane emissions across sectors.

Philanthropists or catalytic capital providers can drive outsized impact by providing flexible, risk-tolerant, and patient funding to initiatives that build the ecosystem and support impact-focused solutions. Some examples include:

1. *Seed proof-of-concepts and the development of promising new and innovative products and models*
2. *Building a supportive ecosystem by funding research, measurement, convening, and coordination efforts*
3. *Bridging capital gaps and crowding in additional investment by offering flexible funding*
4. *Sustaining impact-focused organizations whose inherent business models require low-cost or grant (~100% return) financing on an ongoing basis*
5. *Funding pilot programs and spurring adoption*
6. *Developing human capital by funding capacity-building initiatives*
7. *Creating an enabling environment by funding policy & advocacy; education & awareness leading to behavior change*

> *Investments in ending food waste and loss will yield the desired emissions cuts.*

Philanthropy's priority for reducing methane emissions to the maximum extent possible should be investment in upstream solutions that target food waste prevention at its source.

Organizations like Verra are undertaking exciting work that will pull downstream capture and recycling strategies into the private markets through offset schemes that compensate actors for avoided emissions that can be proven, such as diversion from landfill.

Regulations like the Clean Air Act and policy measures like organic waste bans are also focused on downstream emissions. This means that philanthropic capital is most needed, and most valuable, in addressing methane emissions upstream at their root – by reducing food loss and waste.

Investments in ending food waste and loss will yield the desired emissions cuts, while also delivering on the promise of a more sustainable and equitable future for all. ReFED estimates that achieving our federal goal of cutting food waste by 50% will reduce greenhouse gas emissions by 75 million metric tons, save four trillion gallons of water, and recover four billion meals for those in need. To achieve those results, a $14 billion annual investment is needed over the next eight years. Of that, we estimate $1.27 billion in philanthropic support is required annually.

$1.27B **of philanthropic support is required annually to achieve our federal goal of cutting food waste by 50%.**

Connect With Us

ABOUT ReFED

ReFED is a national nonprofit dedicated to ending food loss and waste across the U.S. food system by advancing data-driven solutions. ReFED leverages data and insights to highlight supply chain inefficiencies and economic opportunities; mobilizes and connects people to take targeted action; and catalyzes capital to spur innovation and scale high-impact initiatives. ReFED's goal is a sustainable, resilient, and inclusive food system that optimizes environmental resources, minimizes climate impacts, and makes the best use of the food we grow.

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