

The Science Behind the Magic

RESEARCH CONDUCTED BY
Matthew Hoekstra, Ph.D. and Julia Singer, BSc (Hons)



Introducing: The Future of Food Waste™

This research delves into the critical issue of food waste and its significant contribution to global greenhouse gas emissions. With a focus on Canada, the study highlights that a substantial portion of methane emissions originates from household food waste. In response to this environmental challenge, Food Cycle Science presents an innovative solution—the FoodCycler™—an energy-efficient household machine that effectively converts food waste into a valuable soil amendment called Foodilizer™. By exploring the technology's environmental impact and potential benefits, this study aims to shed light on the importance of sustainable waste management practices for a more ecologically conscious future.

Why Is Food Waste Such a Huge (and Smelly) Problem?

Food waste is responsible for up to 10% of global greenhouse gas emissions¹. When disposed of in landfill, food waste decomposes and creates methane gas that is approximately 30 times more harmful than the CO₂ emissions from our vehicles.

Methane emissions represent 14% of Canada's total greenhouse gas emissions³ (Figure 1).

Waste accounts for close to a third of those methane emissions (Figure 2), and the vast majority of that waste is from landfills³ (Figure 3). Approximately 16 billion kg (17.6 million tons) of biodegradable waste—including food waste—were landfilled in 2018³. All of this landfilled waste is currently producing methane and will continue to produce methane for many more decades³. Canadian households contribute significantly to food waste ending up in

CANADA'S TOTAL GHG EMISSIONS 2020 IN MEGATONS (MT) (672 MT CO₂E)

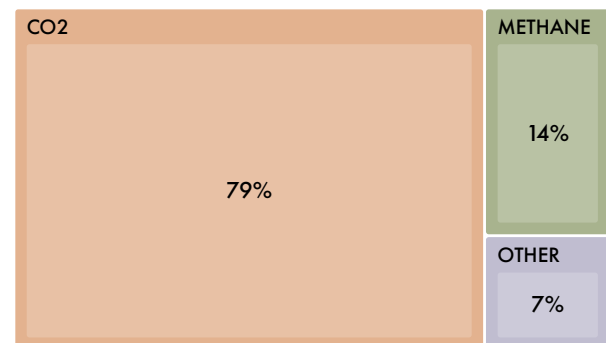
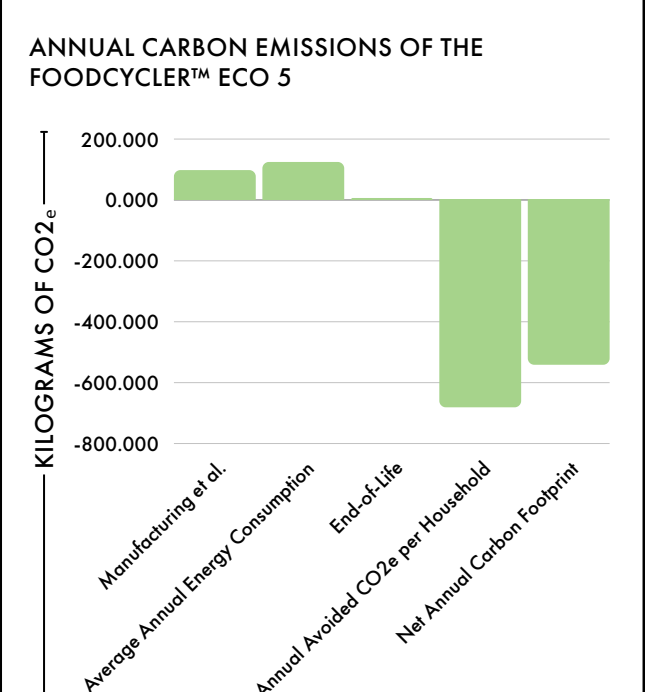
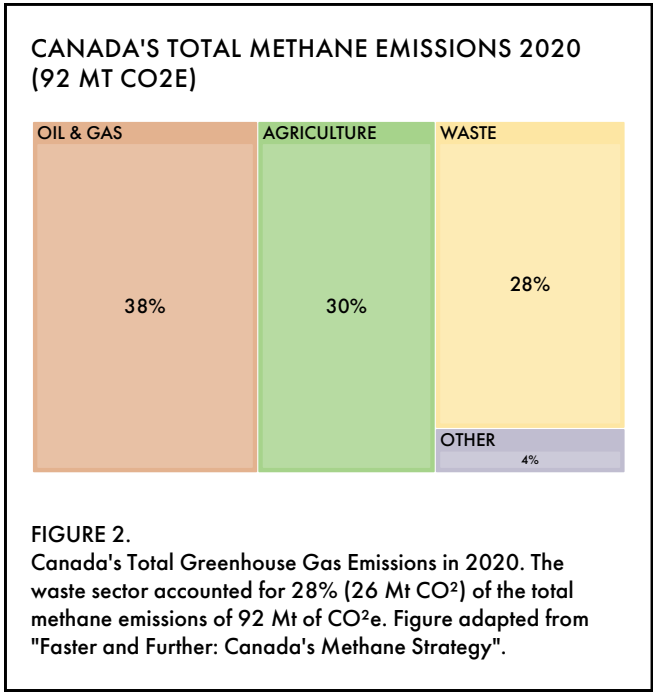


FIGURE 1.
Canada's Total Greenhouse Gas Emissions in 2020. Methane emissions accounted for 14% (94 Mt CO₂) of the total GHG emissions of 672 Mt of CO₂e. Figure adapted from "Faster and Further: Canada's Methane Strategy".
CO₂E (531 Mt CO₂e)
OTHER (47 Mt CO₂e)

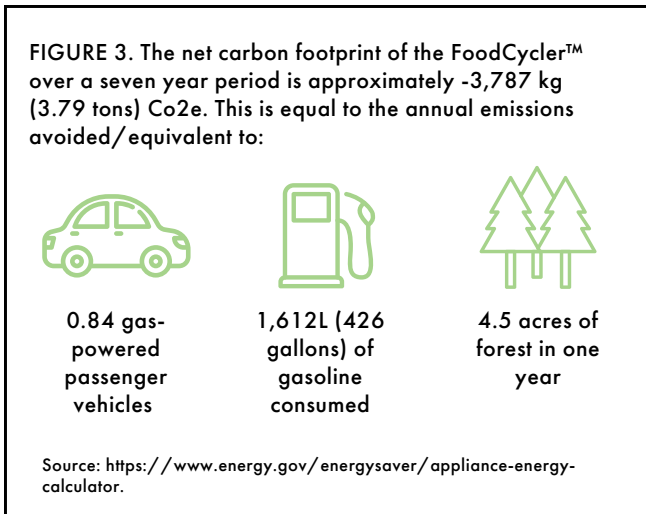
significantly to food waste ending up in landfills: food waste represents 30% of the waste disposed of by Canadian households³.

In 2016, Canadians disposed of just under 6 billion kg (6.6 million tons) of food waste from their residences⁵. This is the same weight as almost 1.1 million elephants⁶. Landfill methane emissions in 2020 were more or less the same as they were 20 years ago³. Methane's global warming potential is highest during the first 20 years it is in the atmosphere, meaning it warms the Earth the most during this time⁷. Because Canada's landfill methane emissions have not been decreasing during the time period when methane is the most harmful to our planet, we need to urgently address the problem at the source: household food waste.



The Solution

Food Cycle Science has a solution to divert household food waste from landfill. With the push of a button, the FoodCycler enables consumers to reduce the global warming impact of food waste without dealing with the mess and smell of conventional disposal methods. The FoodCycler is a compact, low-energy household machine that uses our patented Vortech™ grinding system to reduce food volume by up to 90%. This innovative technology uses high heat to pulverize and dehydrate food waste, resulting in a by-product we call Foodilizer™.



Since the FoodCycler processes food waste in a closed-loop, aerobic environment, it emits zero methane gas and is odour-free thanks to our carbon filter system. Foodilizer is not compost, but it is a nutrient-rich soil amendment that can be added at appropriate ratios to soil as a fertilizer, composted in backyards, or processed in centralized composting facilities⁸. Regenerative Waste Labs⁹, a leading research and consulting firm has provided recipes for incorporating Foodilizer of different compositions in home and municipal composting settings. When added to a compost pile and moderately rehydrated, Foodilizer has a significantly higher surface area for microbial activity, which accelerates the composting process⁸. When used as a fertilizer and integrated at appropriate ratios, Foodilizer also provides beneficial nutrients for optimal vegetation growth.

Once incorporated into the soil, Foodilizer is broken down by soil bacteria and releases these valuable nutrients while adding organic matter into the soil.

The Environmental Impacts of FoodCycler™ Technology

Food Cycle Science sees the technology as complementary to—not in competition with—existing food waste diversion strategies and infrastructure. With curbside organics collection systems, the collection and transportation of food waste creates greenhouse gas emissions from additional transportation vehicles on the road.

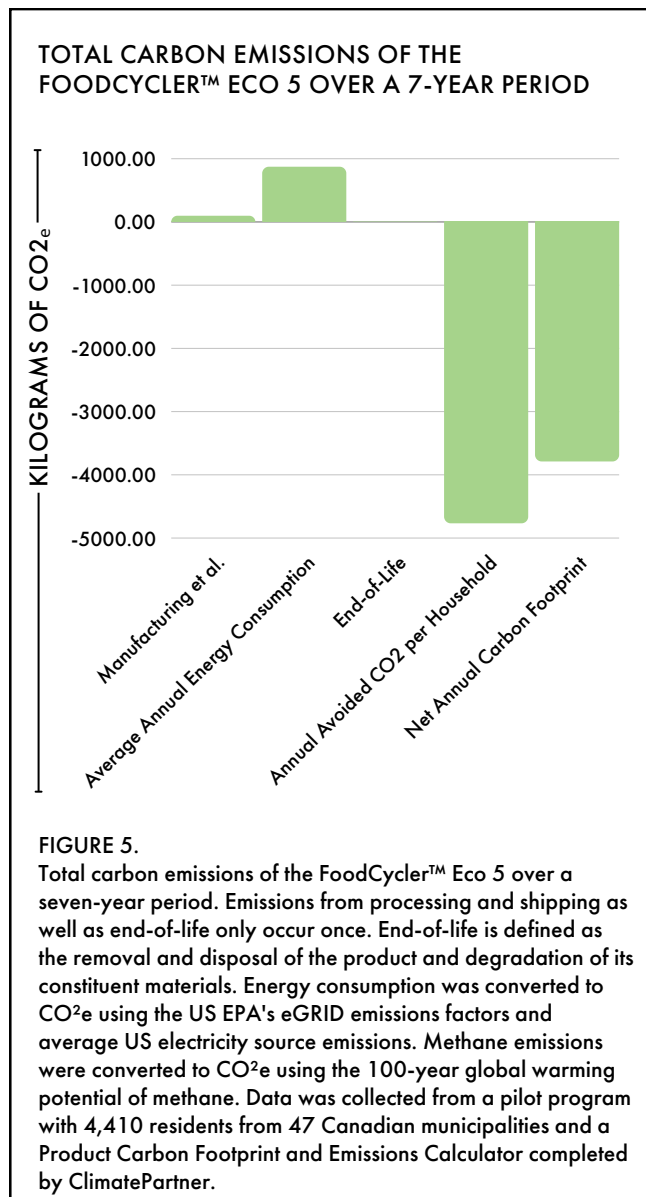


FIGURE 5. Total carbon emissions of the FoodCycler™ Eco 5 over a seven-year period. Emissions from processing and shipping as well as end-of-life only occur once. End-of-life is defined as the removal and disposal of the product and degradation of its constituent materials. Energy consumption was converted to CO₂e using the US EPA's eGRID emissions factors and average US electricity source emissions. Methane emissions were converted to CO₂e using the 100-year global warming potential of methane. Data was collected from a pilot program with 4,410 residents from 47 Canadian municipalities and a Product Carbon Footprint and Emissions Calculator completed by ClimatePartner.

AVERAGE ENERGY CONSUMPTION OF COMMON HOUSEHOLD APPLIANCES OVER AN 8-HOUR CYCLE (KWH)

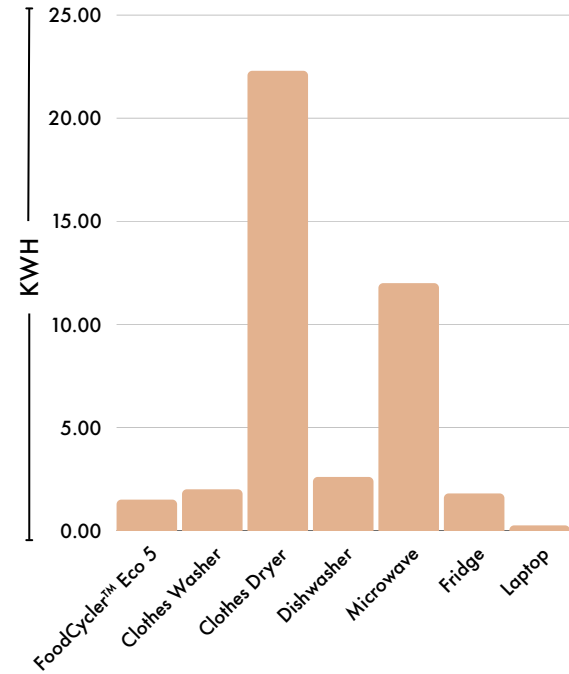


FIGURE 6. Energy consumption of common household appliances over an 8-hour cycle compared to the FoodCycler™ Eco 5. Wattage values for appliances are samples only; actual values vary depending on appliance age and features. The lifespan for all appliances is 7-14 years, with the exception of the laptop, which has a lifespan of 3-5 years.

Source: <https://www.energy.gov/energysaver/appliance-energy-calculator>.

The key benefit of the FoodCycler is its ability to divert organic waste from landfills that would otherwise generate significant greenhouse gas emissions and reduce vehicle emissions from food waste transportation. Household food waste that is processed in the FoodCycler would, in most cases, otherwise end up in a landfill. Over a seven-year period (the conservative expected life of the unit), the FoodCycler diverts 2,450 kg (2.45 tons) of food waste. This quantity is based on the Municipal Pilot Program Resident Survey, aggregating data from 4,410 residents across 47 Canadian municipalities using the FoodCycler FC-30 (2.5 L unit) and Eco 5 (5.0 L unit) as of November 2022. Survey results were validated by third-party consultants through the Impact Canada Food Waste Reduction Challenge. The environmental impact of the FoodCycler is minimal in terms of both its carbon footprint and energy consumption. The

annual net carbon footprint of the FoodCycler is -541 kg CO₂e (0.54 tons), meaning it avoids more greenhouse gases than it emits (Figure 4).

In Conclusion

This study emphasizes the pressing need to address food waste's environmental impact. The FoodCycler offers a practical solution by diverting waste from landfills and producing a nutrient-rich soil amendment. This innovative technology shows promise in reducing greenhouse gas emissions, promoting responsible waste management, and contributing to a greener future.

To learn more about **FoodCycler**, please visit:

www.foodcycler.com

To learn more about **Food Cycle Science**, please visit:

www.foodcyclescience.com

References

1. United Nations Environment Programme. Food Waste Index Report 2021.; 2021:100.
<https://www.unep.org/resources/report/unep-food-waste-index-report-2021>
2. United States Environmental Protection Agency. Importance of Methane. Global Methane Initiative. Published January 11, 2016. Accessed May 2, 2023. <https://www.epa.gov/gmi/importance-methane>
3. Environment and Climate Change Canada. Faster and further: Canada's methane strategy. Published online September 2022. <https://publications.gc.ca/site/eng/9.915545/publication.html>
4. Waste Reduction and Management Division, Environment and Climate Change Canada. Taking Stock: Reducing Food Loss and Waste in Canada.; 2019:40.
<https://www.canada.ca/en/environment-climate-change/services/managing-reducing-waste/food-loss-waste/taking-stock.html#toc8>
5. Environment and Climate Change Canada. National Waste Characterization Report: The Composition of Canadian Residual Municipal Solid Waste.; 2020:73.
https://publications.gc.ca/collections/collection_2020/eccc/en14/En14-405-2020-eng.pdf
6. Grubb P, Groves C, Dudley J, Shoshani J. Living African elephants belong to two species: *Loxodonta africana* (Blumenbach, 1797) and *Loxodonta cyclotis* (Matschie, 1900). *Elephant*. 2000;2(4). doi:10.22237/elephant/1521732169
7. United States Environmental Protection Agency, Office of Air and Radiation. Understanding Global Warming Potentials. Published January 12, 2016. Accessed June 27, 2023. <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>
8. Schroeder JT, Labuzetta AL, Trabold TA. Assessment of Dehydration as a Commercial-Scale Food Waste Valorization Strategy. *Sustainability*. 2020;12(15):5959. doi:10.3390/su12155959
9. <https://www.regenwastelabs.com/>

