ORCA

Food Waste Industry

BOUNDLESS
IMPACT RESEARCH & ANALYTICS

Climate Impact Profile
April 2021

Confidential

Company Description

ORCA is a hyperlocal food waste processing technology that reduces the transportation footprint of food waste and its end-of-life impact. It is part of the Minus Global portfolio of waste technology solutions. ORCA has sold over 3,000 units worldwide through its four different processing capacity models. The OG50 digester converts food waste into a liquid that can be safely discharged into the municipal wastewater system, where depending on the location, the liquid can be turned into energy or used as fertilizer.

Headquarters	Toronto, Canada
Founded	2012
Business model	C-Corp
Employees	20
Stage of development	Expansion
Parent Company	Minus Global
Website	https://www.feedtheorca.com/

Alignment with SDGs

Industry, Innovation and Infrastructure

Sustainable Cities and Communities

Climate Action

Life Below Water

Climate Impact Score: 7.9/10

Boundless Analysis

- This profile compares the ORCA OG50 technology against traditional food waste solutions such as landfills, composting services, anaerobic digestion, and traditional in-sink grinders.
- The Climate Impact Score is based on per unit impact for key performance indicators such as Greenhouse Gas (GHG) Emissions, Water Pollution, and Air Emissions. A high Climate Impact Score indicates better performance against competitors.
- Boundless scores ORCA OG50 7.9/10 per unit impact. The score rationale can be found in Appendix G.
- Measured per metric ton of food waste, the OG50 food digester has a lower transportation footprint and water eutrophication potential than competing food waste treatment options.
- For every one thousand dollars invested in ORCA OG50, 18 metric tons of CO2e can be saved on average, equivalent to the carbon sequestered by 23 acres of U.S. forest in one year.
- A customer using OG50 can avoid an estimated 235 kilograms of CO2e per every metric ton of food waste disposed through the OG50 instead of the traditional pathway. This is equivalent to avoiding driving 591 miles in a passenger car.
- The city of New York has suspended curb-size composting services until at least May of 2021. This is approximately 38 thousand tons of food waste placed in landfills. The use of OG50 would offer a useful solution, especially in these times.
- ORCA is NSF certified, meaning the OG50 meets the standards for food safety and sanitation, proving to be a safe and effective food waste solution.

Management Team

- **Louis Anagnostakos, CEO,** has been the CEO of ORCA and its parent company Minus Global Holdings since March 2016. A 30-year waste management industry veteran, including 22 years as a CEO at Turtle Island Recycling Corp., a multi-material recycling and waste removal company prioritizing recycling from small businesses to large corporations. Louis founded Turtle Island Recycling Corp. from scratch and grew it to sales of $100 million annually employing over 500 people before selling it in 2011.
- **Scott Tracey, President of ORCA North America,** has been the president of ORCA for the last nine months after being Vice President of Operations for a year. Prior to ORCA, Scott worked as a senior level supply chain and global operational professional at several companies. These companies including Scott Tracey Supply Chain Services, MHI Canada Aerospace Inc, Umbra, and Bombardier Aerospace. During Scott's time at these companies, he led teams of over 100 people, managed a billion dollars in annual expenditures by negotiating supplier contracts, and eliminated $20 million in costs by optimizing distribution services and leveraging lean enhancements.

Technology

- ORCA technology, is a microbial-based technology that is designed to mimic the natural digestion process. ORCA addresses food waste by creating a thermophilic biological environment, in which the microorganisms digest the food waste, transforming this waste into a liquid.
- ORCA's use of their proprietary microorganism solution, Biochips*, plus oxygen and water, creates an optimal environment for aerobic digestion. The benign liquid is environmentally safe. After it exits the OG50, it passes through a screen with holes the size of the tip of a pencil (0.5 mm) before entering the sanitary sewage system.
- The ORCA process involves no grinding or shredding, chemicals used, or solids generated that require additional handling, along with a significant reduction in odor.
- ORCA is NSF certified, meeting the rigorous requirements of the National Sanitation Foundation. The NSF creates the standards for public health protection through testing public health and environmental safety standards on an annual basis. ORCA prioritizes product quality and user safety, undergoing an extensive process necessary to obtaining certification, including a series of inspections and reviews. This demonstrates ORCA's mission to prioritize global safety regulations.

Operations

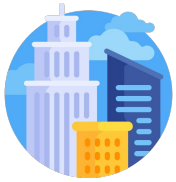
- ORCA's headquarters are located in Toronto, Canada.
- ORCA is a portfolio company of Minus Global Holdings.
- ORCA has operations in the U.S, United Arab Emirates, Barbados, Hong Kong, and Canada and distributes through partnerships in 15 countries.

Environmental Highlights

Summarized below are the most relevant impact categories and codes that refer to the United Nation's Sustainable Development Goals (SDGs). The associated metrics highlight the most important factors that explain how this technology is impacting the environment.

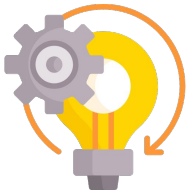
Greenhouse Gas Emissions

The processing of food waste using ORCA OG50's digester has lower GHG Intensity (GHG Footprint presented in this report as CO2-equivalent per ton of food waste processed) compared to traditional food waste solutions such as landfills and traditional in-sink grinders, but higher than composting and anaerobic digestion. The GHG Footprint per metric ton of food waste processed ranges from 8.8 to 13.2 kgCO2e. Per one-thousand-dollar investment in OG50, 18 metric tons of CO2 emissions can be avoided by displacing food waste from a more traditional pathway. OG50's estimated GHG Footprint is 96% lower than the GHG footprint of landfills and 81% lower than traditional in-sink waste processors. Note that this analysis uses the 100-year GWP, or Global Warming Potential. Using an alternative 20-year GWP assumption shows a GHG Footprint of OG50 is 13.09 kgCO2e per metric ton of food waste processed.
Relevant Code: SDG 13.



Sustainable Cities and Communities

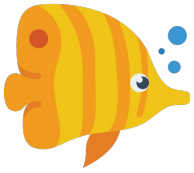
The ORCA OG50 and in-sink grinders share the benefit of needing virtually no transportation from the origin of the food waste to its final destination. OG50 and in-sink grinders have an estimated Transportation GHG Footprint of only 0.06 kgCO2e per metric ton of food waste, 99% percent lower than the footprint of landfill, anaerobic digester, and composting. OG50 matches the in-sink grinder in terms of their kgCO2 for the Transportation Footprint. However, in-sink grinders are nearly nonexistent in New York, because until 1997, they were banned due to their perceived threat to the sewer system. Compared to the other alternative food waste options that require primarily trucks, trains, and barges, ORCA supports sustainable cities and communities by reducing the need for polluting transportation.
Relevant code: SDG 11.



Industries, Innovation, and Infrastructure

ORCA is innovating the food disposal industry, given the stress that food disposal is putting on the environment, primarily through their Transportation and Water Eutrophication Footprint. This product addresses these problems, simplifying the complex traditional process, which includes several energy-intensive steps due to the transfers and sorting of waste. Food waste is transported (often hundreds of miles) to the nearest landfill that will accept it. The number of landfills accepting NYC waste is decreasing, and waste is traveling farther out of state as a result. ORCA addresses this problem by integrating it into the public water system and allowing it to be treated in wastewater treatment plants.

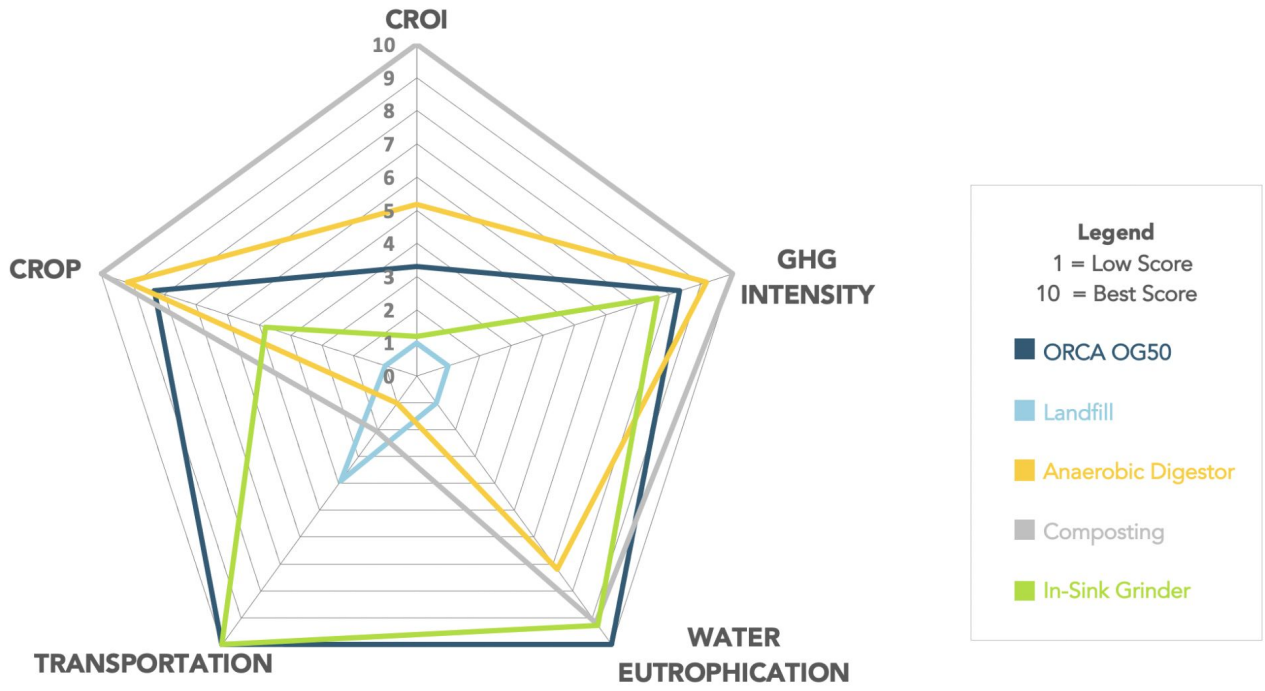
Relevant Code: SDG 9.



Life Below Water

Eutrophication is defined by the levels of nitrates and phosphates that encourage excessive growth of algae and reduced oxygen levels, measured in PO4 equivalent per metric ton of food waste. Wastewater treatment plants have deployed technology which removes phosphorus. Since ORCA's technology utilizes public wastewater treatment plants, the OG50's Eutrophication Footprint is hindered and even reduced. OG50's Water Eutrophication Footprint is estimated as 0.2 kgPO4 per metric ton of food waste, averaging 24% less than its competitors.
Relevant code: SDG 14

Benchmarking and Conclusions



According to the last waste characterization study[1] carried out by the NYC Department of Sanitation (DSNY), 21% of the waste generated in the city corresponds to food scraps suitable for composting. In the U.S., most of the food waste goes to landfill[2], an alternative that emits large amounts of methane to the atmosphere from the decay of the organic waste. Processing food waste using the OG50 digester has significantly lowered the GHG Footprint compared to sending this waste to landfills or the traditional pathway of food waste (56% landfill, 28% anaerobic digestion, 12% combustion, and 4% compost).

Per one-thousand-dollar investment in OG50, 18 metric tons of CO2 emissions can be avoided by displacing food waste from the more traditional pathway. A customer using OG50 can avoid an estimated 235 kilograms of CO2e per every metric ton of food waste disposed through the OG50 instead of the traditional pathway, the equivalent to avoid driving 591 miles in a passenger car. Individually, the GHG Footprint of OG50, estimated as 11 kgCO2e per metric ton of food waste processed, is 98% lower than the GHG Footprint of landfills, and 5 and 10 times higher than anaerobic digestion and composting respectively.

Compared to other alternative pathways for food waste, OG50 has lower Water Eutrophication potential. The Water Eutrophication Metric indicates the level of excessive nutrients leaking into water bodies due to each waste management option. An overload of nutrients causes a reduction in oxygen levels, thus affecting aquatic flora and fauna. OG50's Water Eutrophication Footprint was estimated to be 40% lower on average than alternative technologies used for food waste.

New York City has a long and complicated history with its waste. Through the 1880's, 75% of NYC's waste was dumped into the Atlantic Ocean. The last NYC landfill, Fresh Kills, was closed in 2001. Fresh Kills Landfill was meant to be a temporary landfill but was open for over 50 years. The City of New York has been shipping its waste down the east coast and into upstate New York, transporting waste hundreds of miles, while emitting greenhouse gases in this transportation scheme. Also, only 1% of the waste collected by the DSNY in 2019 corresponded to organic waste separated by residents through a program suspended in May 2020 due to the pandemic. Boundless concludes that together with anaerobic digestion and composting, ORCA presents a significant alternative to reducing food waste GHG emissions. Also, OG50's technology reduces transportation and avoids logistical complications that result with food waste in landfills.

(1) Source: https://dsny.cityofnewyork.us/wp-content/uploads/2018/04/2017-Waste-Characterization-Study.pdf
(2) Source:https://www.epa.gov/sites/production/files/2021-01/documents/2018_ff_fact_sheet_dec_2020_fnl_508.pdf

Environmental Key Performance Indicators (EKPIs)

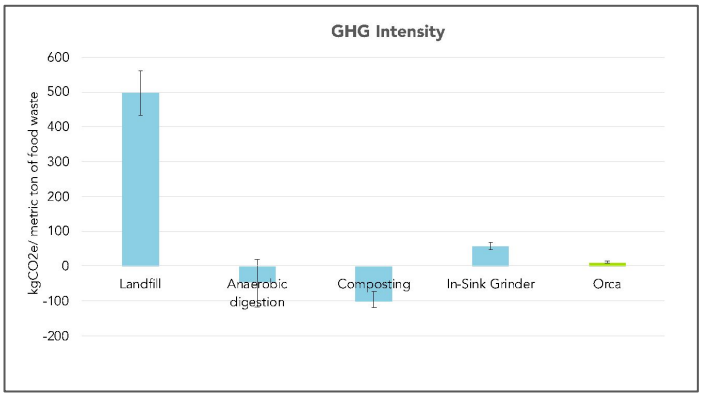
We evaluated the life-cycle inputs and impacts per metric ton of food waste treated with the ORCA OG50 digester for a New York City scenario, considering raw material production, procurement, and operation processes. Results are compared to traditional food waste solutions such as landfills, composting services, anaerobic digestion, and traditional in-sink grinders.

NOTES: Consistent with conventions in the financial sector, we use the Roman numeral "M" to denote "thousand" and "MM" for "millions."

Product GHG Intensity

Greenhouse gas (GHG) emissions measured as CO2 equivalent per ton of food waste processed.

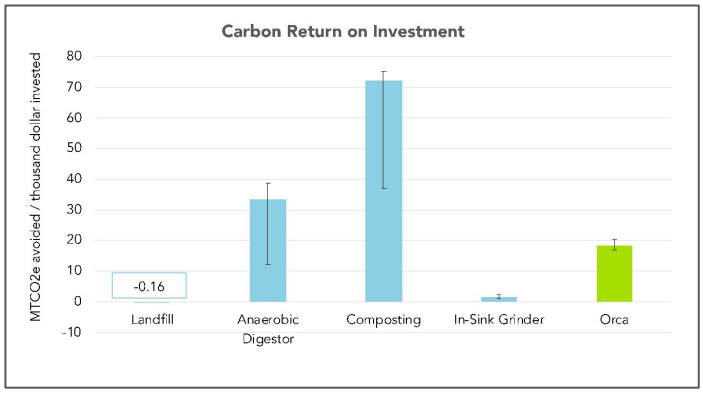
- GHG emissions for the ORCA OG50 food waste digester ranged from 8.8 to 13.2 kgCO2e per metric ton of food waste processed.
- OG50's estimated GHG Footprint is 96% lower than the GHG Footprint of landfill and 81% lower than traditional In-sink waste processors.
- Anaerobic digestion and composting presents negative emissions due to increase in soil carbon storage from the application of the digester or compost to soil. These offsets are due to avoided utility emissions through biogas production and avoided fertilizer use.



Carbon Return on Investment (CROI)

Measures the climate impact (positive or negative) of each thousand dollars (USD) in equity capital investment in the OG50 to replace traditional food waste solutions.

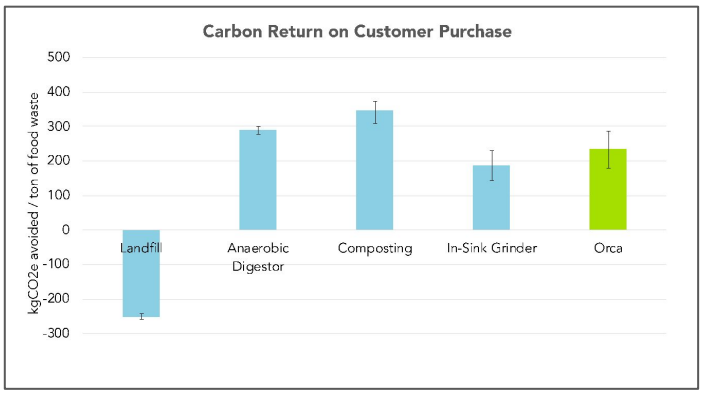
- The CROI was calculated considering the use of each food waste processing solution instead of the status quo (56% landfill, 12% combustion, 28% anaerobic digestion, and 4% composting[1]).
- The Carbon Return on Investment of OG50 was estimated as 18 metric tons of CO2e avoided per thousand dollar invested, 12 times higher than the CROI of a traditional in-sink grinder, due to the lower processing capacity of the in-sink grinder.



Carbon Return on Customer Purchase (CROP)

Measures the greenhouse gas emissions avoided by customers per metric ton of food waste processed.

- The CROP shows that OG50's customer can realize significant GHG savings by investing in this solution, compared to traditional pathways for food waste.
- OG50's CROP ranges from 181 to 288 kg of CO2e per metric ton of food waste, 19% and 32% lower than anaerobic digester and composting respectively, and 25% higher than traditional in-sink grinders.
- Each metric ton of waste processed using one of the assessed solution is assumed to be avoiding the traditional path of food waste[1].



(1) https://www.epa.gov/sites/production/files/2021-01/documents/2018_ff_fact_sheet_dec_2020_fnl_508.pdf

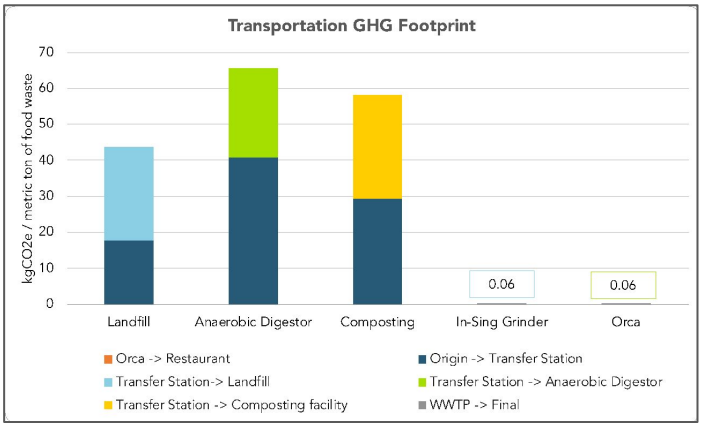
EKPIs continued

Calculations of environmental metrics used to determine climate impact benefit. NOTES: Consistent with conventions in the financial sector, we use the Roman numeral "M" to denote "thousand" and "MM" for "millions."

Transportation GHG Footprint

Measures the emissions due to the transportation of food waste from the point of generation to its final destination

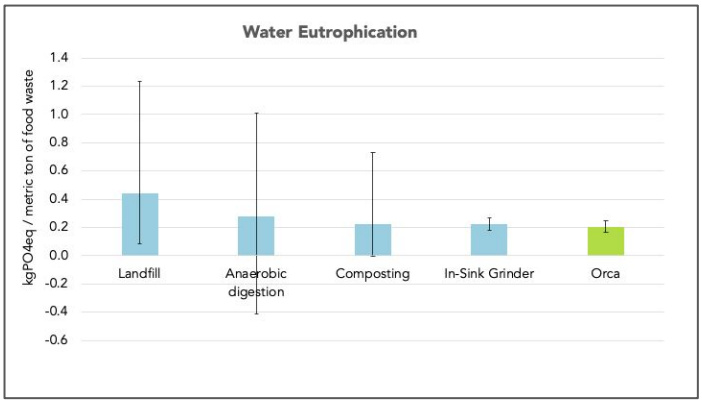
- The Transportation GHG Footprint for the OG50 food waste digester is estimated as 0.06 kgCO2e per metric ton of food waste transported.
- The Transportation GHG Footprint of OG50 is on average 99% lower than the transportation footprint of landfill, anaerobic digestor and composting.
- Most of the Transportation Footprint of the landfill, anaerobic digester, and compost alternatives are due to the use of trucks to transport food waste from the point of origin to the final destination.



Water Eutrophication Footprint

Measures the eutrophication due to the food waste processing. Eutrophication is defined as levels of nitrates and phosphates that encourage excessive growth of algae and reduce oxygen levels, measured in PO4 equivalent per metric ton of food waste.

- Water Eutrophication for OG50 is estimated as 0.2 kgPO4 per metric ton of food waste processed.
- The estimated Water Eutrophication Footprint of food waste processed with OG50 is on average 24% lower than its competitors.



APPENDIX A: Methodology

Key Goals

Key goals of this analysis were to:

1. Examine Environmental Key Performance Indicators (EKPIs) in conjunction with financial data to arrive at environmental and hybrid environmental-financial metrics for the OG50 digester versus comparable traditional waste management systems.

2. Provide equitable comparisons among relevant alternative technologies.

3. Incorporate a variety of methodological considerations relevant to the food waste industry and apply them to the results.

To ensure that these key goals were met, we hired an independent industry expert to review the study and assumptions to ensure the methodology was corresponded with industry standards. The expert review and commentary notes are provided in Appendix D.

Methodology

To address the first goal, Boundless researched the material, energy, and performance characteristics for the OG50 digester, based on detailed information provided by ORCA's team describing the material components and energy inputs. At the core of the methodology is a life-cycle assessment (LCA) model for an OG50 digester. The functional unit (FU) for this LCA was one ton of food waste treated by the OG50 and its competitors. We used SimaPro v9.0.0.41 and employed the IPCC 2013 methodology when calculating life-cycle impacts of material and energy systems not described elsewhere in the literature.

Each metric compares the OG50 digester against alternative technologies. Metric construction for industry alternatives relies on comparisons, for which we relied on scientific literature, industry reports, white papers, as well as assumptions provided by the industry expert. The impact metrics are reported graphically using bar charts to illustrate a baseline result value, along with sensitivity bars reflecting a range of possible result values around deployment scenarios and key variables.

Research Approach

- Followed a life-cycle Assessment approach and leveraged professional LCA software/data and scientific literature.
- Investigated non-GHG metrics, including water footprint and carbon return on investment.
- Accounted for emissions offsets occurring from hypothetical marginal electricity system impact assuming energy storage facilitated renewable generation by a 1:1 ratio.
- Identified sources of uncertainty and quantified their impact, seen in the results.
- Included essential financial and operational variables to estimate the cost of production.

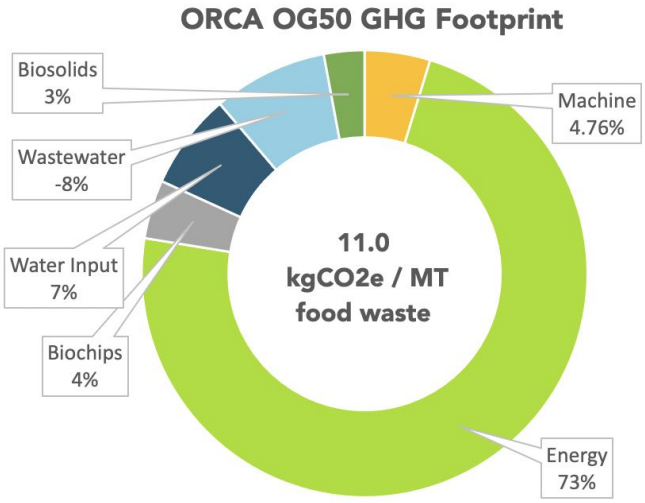
APPENDIX B: List of Metrics

EKPI	Unit of Measure	Description
Product GHG Intensity	kgCO2e / metric ton food waste	A measure of the greenhouse gas impact per metric ton of food waste treated.
Carbon Return on Investment	MTCO2e / $1 M investment	A measure of the climate impact (positive or negative) of each $1 thousand dollars (USD) of investment.
Water Eutrophication	kgPO4e / metric ton food waste	Measures the phosphates and nitrates due to the food waste processing.
Carbon Return on Customer Purchase	kgCO2e / metric ton food waste	A measure of the greenhouse gases avoided by customers per metric ton of food waste.
Transportation GHG Footprint	kgCO2e / metric ton food waste	A measure the emissions generated during the transportation per metric ton of food waste

Appendix C: Summary of Life Cycle Product Inventory

Greenhouse gas (GHG) emissions associated with the food waste processing using OG50, measured as kilogram of CO2 equivalent per metric ton of food waste processed.

The estimated GHG emissions associated with the operation of OG50 are 11 kilograms of CO2e per metric ton of food waste



APPENDIX D: Independent Expert Review

Independent Industry Expert

Jeffrey Morris is an economist and principal of Sound Resource Management Group (SRMG), which was incorporated in Washington State in 1987. Morris has a Ph.D. in economics and M.A. in mathematical statistics, both from the University of California – Berkeley, and an M.B.A. in operations research and finance from Northwestern University. He has more than 40 years of experience researching and analyzing municipal solid waste (MSW) management practices. He regularly consults with municipalities and counties, state environmental agencies, provincial environmental agencies, and NGOs. Morris has published life cycle impact analyses of MSW treatment methods in the peer-reviewed scientific literature, e.g., Environmental Science & Technology, Journal of Industrial Ecology, International Journal of Life Cycle Assessment, and Journal of Hazardous Materials. He also regularly publishes in Resource Recycling and BioCycle

Summary of Expert Review

Organic Refuse Conversion Alternative (ORCA) is a microorganism-based method for aerobically digesting food waste without grinding, shredding, or chemicals use. Post processing, digestate is passed through a 0.5-millimeter screen, and then travels through the municipality's sewer system to a wastewater treatment plant. The Boundless Impact assessment estimates climate and water eutrophication impacts of ORCA, but does not consider other environmental impacts often included in a multi-impact LCA such as human health (respiratory, toxicity and carcinogenicity), ecosystem health, acidification, ozone depletion, and smog formation. Also, the data ORCA provided for the assessment is limited in terms of comprehensive emissions measurements at input, processing, and outputs stages of the food waste in-vessel treatment.

The Boundless assessment of the GHG Footprint for ORCA appear to be accurate, except for the CO2 and other GHG emissions, along with ammonia and other non-GHG emissions, that may occur during the aerobic digestion process. There also does not appear to be any accounting for climate impacts of managing solids that are screened out prior to flushing of liquified food wastes and processing water. The comparisons against AC and AD are reasonable, but they do not include atmospheric carbon sequestration benefits from enhanced plant growth on compost-amended soils as discussed in recent peer-reviewed scientific literature on soil productivity. In addition, the GHG benefits of water conservation provided by aerobic composting (AC) and anaerobic digestion (AD), versus the additional water usage by ORCA, do not appear to be entirely addressed. Also there is a need for a more detailed analysis of how ORCA differs from in-sink grinding (ISG) to reduce its GHG Footprint relative to ISG. Finally, the truck and train transportation GHG emissions estimates per metric ton kilometer are too large relative to estimates provided in other studies. Transport is evaluated as part of climate impacts; it should not be called out as a separate category in spider chart comparisons or the text. This is a double counting of environmental impacts.

The Boundless eutrophication impact assessment substantially underestimates water eutrophication reduction benefits of reduced fertilizer and herbicide/pesticide production, as well as reduced fertilizer soluble nitrogen runoff, from compost applications to soils. This Boundless assessment also does not use EPA's TRACI (Tool for the Reduction and Assessment of Chemical and other Impacts). TRACI is currently the standard emissions characterization tool used for U.S. life cycle impact assessments. Given these shortcomings, the eutrophication impact assessment of ORCA and its competitors should not have a separate category in spider chart comparisons or the text of the ORCA climate impact profile. It is cherry picking to only include eutrophication while leaving out other impacts such as respiratory particulate emissions precursors and smog formation that are also sensitive to emissions of nitrogen and ammonia compounds.

The ORCA process is akin to the ISG process, and both are more akin to disposal methods such as landfill and incineration, compared to diversion from disposal methods such as AC or AD. The latter treatments return nutrients to the soils more efficiently and effectively. As a disposal method for food wastes ORCA certainly appears to have major advantages versus landfill, as shown by the Boundless assessment based on ORCA provided emissions data for ORCA. The technology, thus, may be advantageous for food waste generators lacking access to AC or AD

APPENDIX E: Global Warming Potentials

How Global Warming Potential Scenarios highlight the importance of investing in Emission Reduction Technologies

The methane impact from emissions depends on which Global Warming Potential (GWP) is used. GWP is a metric measuring how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide. The larger methane molecule provides a warming potential that is 28-36X that of CO2 in a 100-year timeframe. (That is, over 100 years, methane traps 28 times more heat per mass unit than carbon dioxide). The lifespan of methane in the atmosphere, however, was estimated at 9.6 years, while that of CO2 is much longer (estimated from 20-200 years). In the shorter 20-year timeframe, methane's impact would, therefore, be 84-87X that of CO2, and the GHG savings for all landfill technologies would be greater. Investment in methane reduction using this shorter timeframe increases the return for investment by a factor of 2.2-3X. The 20-year timeframe is especially important when considering critical climate change mitigation efforts needed over the next two decades.

APPENDIX G: Score Rationale

Climate Impact Score

The climate impact value is a number (1=worst to 10=best). This number represents an overall indicator of a company's climate impact performance against its most relevant industry competitors. The value is obtained by comparing the average of each resulting EKPIs for the company against its competitors. The score for each metric can be read from the summary spider chart of the profile for each product. The EKPIs are developed and displayed in the detailed graphs for both the target company and the competing companies.

ORCA has a considerable performance when compared to its competitors. For example, OG50's GHG Footprint is lower than landfill and other in-sink grinders, but higher than composting and anaerobic digester and has a low eutrophication potential comparatively. Using a formulaic comparison to measure relative performance across all EKPIs, ORCA scored a 7.9 out of 10 on its climate performance.

APPENDIX H: Report Development Team

Fernanda Avila Swinburn, Senior Research Analyst
Fernanda graduated from Columbia University in 2018 with a Master's degree in Sustainability Management and a focus on renewable energy, sustainability strategies, data analysis, and life cycle assessment. Prior to Columbia, she graduated from Universidad de Chile with a master's degree in Electrical Engineering. Fernanda has experience modeling demand side management systems for micro-grids and renewable resources forecasting. Her work on these topics was recognized with the first place of the Eco-Logicas Monograph competition, given by the "Instituto para o Desenvolvimento de Energias Alternativas na America Latina". She has worked as a consultant performing energy price projection and the modeling of power purchase agreements for developers and financial institutions. She also has experience developing sustainability strategies and life cycle assessment for organizations in different sectors, such as a music festival, a foundry plant, and a coffee roasting company.

Andreas van Giezen, M.S., Research Analyst
Andreas graduated from Delft University of Technology (TU Delft) in The Netherlands in 2018 with a Master's degree in Management of Technology, focusing on Infrastructure & Environmental Governance. He received a special annotation with his degree for his thesis work focusing on sustainable development of technologies. Prior to TU Delft, he graduated from Inholland University of Applied Sciences with a Bachelors degree in Aeronautical Engineering. Andreas interned for research & development projects at universities in both the Netherlands and China and won a nationwide contest for engineering students active in the energy industry in the Netherlands. He was previously employed at an international engineering consultancy firm, researching the social and technical impacts of ultra-deep geothermal energy projects. Andreas also has experience with academic research on ocean plastic collection logistics.

Leah Motimaya, Junior Research Analyst
Leah graduated from Pennsylvania State University in 2020 as a double major in Earth Science and Policy and Economics with a focus in Energy and Natural Resource Economics. She received Laureate distinction at her university through notable achievement in academic excellence, global literacy and awareness, professional and civic service, and leadership. Her final discourse studied sea level rise and its impact on megacities within developing countries. Leah also studied at Albert-Ludwigs-Universität Freiburg, focusing on Energy Technology, Urban Environmental Planning, and the UN Sustainable Development Goals. During her time in university, Leah has worked in several research and development labs and centers, with papers ranging from urbanization to cellulosic biofuels. In the past, she was employed by environmental non-profits, political campaigns, and documentaries.

Michele Demers, Founder, CEO
Boundless Founder and CEO Michele Demers has 20 years of experience as a philanthropy executive, strategist, and social entrepreneur. She is Founder and CEO of Boundless Impact Investing, a market intelligence platform that provides high-quality, objective, and actionable research and tools to family offices and private investors interested in maximizing the social and environmental impact of their investments. From 2010-2013, she was Vice President at Foundation Source where she built a knowledge platform on best practices in philanthropy that was used by a network of 1200 family foundations. From 2007-2008, Michele was the Director of Communications for Humanity United. She has been involved in the successful development of more than two-dozen philanthropic and nonprofit start-ups, including her own, Tattersall Consulting, from 2002 to 2007. Michele is regularly called upon for her innovative thinking about impact investing and social enterprise. She is a graduate of Pennsylvania State University and has a Master's in International Relations and Communications from Boston University.

Dan Zachary, Research Advisor
Daniel (Dan) S. Zachary, PhD, is the Director for the Energy Policy and Climate Program at Johns Hopkins University. Dan holds a PhD in Nuclear Physics (Energy Density modeling), an MSc in Space/Atmospheric Physics, and a BSc in Gravity Physics, all from the Massachusetts Institute of Technology. Dan's academic research has focused on mathematical and physical modelling for policy support, geo-statistics, earth-atmosphere systems (connections with anthropogenic emissions), global energy sustainability and general (statistical) forecasting methods. Dr. Zachary is author/co-author of over 80+ scientific publications including more than 50 peer-reviewed articles and book chapters and over 25 symposium papers, some chosen for international research awards. He is also the associate editor of the Journal of Environmental Modeling and Assessment Journal.

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About Boundless Impact Research & Analytics

Driven by the latest research by independent industry and academic experts, Boundless Impact offers analysis, market trends, and evidence of best practices in a growing number of emerging sectors that address major social and environmental challenges. We are an advanced consulting firm that enables investors to connect with industry leaders and peers for expert analysis, diverse perspectives, and real-time collaboration. Our investor education and expert advisory services offer proprietary access to both subject-matter experts and other impact investors.

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