

The UN Secretary-General's Advisory Board on Zero Waste

# Revolutionizing on-site food waste valorization through a decentralized replicable approach



Zero waste good practice

The Waste Transformers

Freetown, Sierra Leone

## Disclaimer

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the secretariat of the United Nations concerning the legal status of any county, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries regarding its economic system or degree of development. Excerpts may be reproduced without authorization, on condition that the source is indicated. Views expressed in this publication do not necessarily reflect those of the United Nations Human Settlements Programme, the United Nations Environment Programme, the United Nations and its member states.

Copyright © United Nations Secretary-General's Advisory Board on Zero Waste  
All rights reserved

This good practice is based on the information submitted by the owning organization. The language is based on the submission and only minor edits have been made.

---

Citation: UN SG's Advisory Board on Zero Waste. (2024). Revolutionizing on-site food waste valorization through a decentralized replicable approach. The Waste Transformers.

# Table of Contents

Synopsis	01
Stakeholders and Partners	01
Zero Waste	02
Sustainable Development Goals	02
Background, Challenges, Objectives	03
Actions and Implementations	04
Outcomes and Impact	05
Replicability and Scaleability	06
Inclusion and Innovation	06
Accountability and Sustainability	07
Financial Data	07



# About

## Synopsis

The Waste Transformers, a Dutch company with a global reach allows companies and communities to use their own food waste to co-power their business.

We design, build, and place containerized biodigesters, called Waste Transformers that convert the leftover food waste from businesses and communities into clean electricity and heat to co-power the same site where the food waste is produced. The valuable nutrients in that same food waste, form the basis of a locally produced natural liquid fertilizer, replacing polluting and expensive chemical fertilizers. In this way, we turn food waste into value.

Implementation  
period

**2014 - now**

Country

**Sierra Leone**

Location

**Freetown**

**Stakeholders and Partners:** In Freetown we are building a blue print for African megacities, working towards running 40 Waste Transformers inside the city. Thereby creating low-skilled jobs, diverting food waste from landfill and producing much-needed (clean) energy and natural fertilizer for small-scale farmers. And creating awareness. The following organisations and entities are involved: The Freetown City Counsel and Mayor Yvonne Aki-Sawyer. Climate Fund Manager (CFM): Project financier. UNOPS: Owner of second Waste Transformer in Freetown, running at a food market in Freetown. Salone Waste Transformers: Local entity responsible for the operations and waste collection.

## Connection to Zero Waste

When food waste ends up in the grey bin, it is or incinerated or landfilled. Valuable nutrients are wasted and leading to methane emissions. The decentralized approach through on-site biodigesters, is not only successful in diverting food waste from landfill, it also creates awareness around this waste stream. As landfilling 1 kg of food waste emits the same amount of CO<sub>2</sub> from 25.000 landfilled plastic bottles, local valorisation will lead to less waste. When sustainable activities happen close to people, the behaviour tends to bend in a positive way, decreasing the amount of food people throw away. The local production of natural liquid fertilizer, coming from urban areas. In this way as cities act as a sink for nutrients coming from agricultural land, we allow cities to give back those valuable nutrients to farmers to create a balanced nutrient loop and reduced need and application of chemical polluting fertilizers.

## Contribution to Sustainable Development Goals

There is a distinction: SDGs on which a local Waste Transformer biodigester has a direct impact and those on which we have a second degree impact. Target 2: ensure sustainable food production and resilient agricultural practices, help maintain ecosystems and improve land and soil quality. The natural fertilizer produced can be replaced 1:1 with chemical fertilizer, increasing carbon and nutrients to the soil, instead of depleting soil through chemical fertilizer application.

Target 6: Achieve equitable sanitation and hygiene for all, improve water quality by reducing pollution, eliminating dumping, increase recycling. Food waste in leaking in landfill leads to eutrophication in fresh water and marine water, causing algae blooms and diseases. A local Waste Transformer biodigester divert food waste from landfill to allow the production of fertilizer to restore soil health, less application of chemical fertilizer leading to less run-off of nutrients into fresh water.

Target 7: Increase the share of renewable energy, and access to affordable and reliable energy services. Our locally operating Waste Transformer biodigesters, generate clean energy from biogas. This is locally distributed and provides access to clean energy.

Target 11: Make cities and human settlements inclusive, safe, resilient and sustainable. Access to basic services and upgrade slums. Our Waste Transformer biodigester in Freetown, not only provide jobs for the unemployed, it allows neighborhoods to reduce their waste dumping, leading to cleaner and more assessable neighborhoods, leading to increased feeling of safety.

Target 13: Take urgent action to combat climate change and its impacts. Improve education, awareness raising and human capacity on climate change mitigation, include focusing on women, youth and local communities. Our Waste Transformer biodigesters in Freetown are fed by informal youth groups collecting food waste. Each ton of food waste diverted from landfill to anaerobic digestion, saves 580kg of CO<sub>2</sub> eq.

# Background, Challenges and Objectives

Freetown has a largely undeveloped energy grid, resulting in an increasing difficulty in having access to electricity. On the food waste side, according to a government report, Sierra Leone is approximately producing 656,400 tonnes of crop waste from rice husk, cocoa husk, rice straw etc, with a total annual energy potential of about 2706 GWh, and these number are expected to increase as the agricultural sector grows. The Government of Sierra Leone is also developing a strategic vision to make Sierra Leone Africa's first Zero-Carbon middle-income economy by 2040. The waste management sector is still very unde-

veloped, both on the community and government level: waste is not properly segregated at the source, nor is efficiently collected from the companies working in the sector. Private associations are trying to educate young people on how to correctly divide waste at the source; however, landfilling and illegal dumping are still part of the people behaviour. In Sierra Leone, the market of fertilizer such as compost from biowaste seems not very widespread. Although, the sector of agriculture is one of the most important in this country with 43% of GDP and 5.4 6 million hectares of arable land. The government itself states that there's a need for organic fertilizer to avoid deforestation and soil corrosion, especially in the northern regions. The decentralized approach of on-site food waste valorization is a key driver in Freetown to work on local job creation, local energy production, local waste diversion from landfill and local awareness creation through neighbourhood visibility. The decentralized approach is key in urban settings with underdeveloped waste management logistics.

Key objectives: The total project in Freetown entails placing and operating 40 Waste Transformer biodigesters, at strategic locations in and around Freetown. Collaboration with local informal youth groups collecting the waste streams, allow young Freetownians to participate in a green economy. The food waste fertilizer produced, will be centrally processed and marketed to farmers outside Freetown. In this way, the nutrient loop is circled back to agricultural land, restore soil health and make the soil more resilient towards the impact of heavy weather patterns caused by global heating.

Placement: 40 Waste Transformer biodigesters, processing each around 2,000kgs food waste per day.

Energy production: Each Waste Transformer biodigester, processing around 2,000kgs per day, can produce 220.000kWh electricity, 440.000 thermal kWh heat and 708.000 litres digestate.

Total yearly expected output (40 biodigesters):

- 8.800.000 kWh electricity
- 17.600.000 tkWh heat
- 31.200.000 litre natural fertilizer
- 29.200.000 kg food waste diverted from landfill each year.

**“In Freetown, the decentralized approach of on-site food waste valorization drives local job creation, energy production, waste diversion from landfill, and awareness creation, especially in urban settings with underdeveloped waste management logistics.”**

# Actions and Implementation

---

In the actions and implementation chapter, the steps taken to achieve sustainable waste management are outlined.

'Between Sept 2015 and June 2016 The Waste Transformers and Masada Waste Management explored the feasibility of generating green power in Freetown through a waste to energy solution in Freetown Sierra Leone. Resulting in a Feasibility Study.

2016: Morgan Stanley Sustainable Impact Investment Challenge recognizes The Waste Transformers Fund as one of top three investment plans.

2019: Placement of first Waste Transformer biodigester in Freetown next to Aberdeen Women Center in Freetown. On-site training was given by The Waste Transformers to 50 staff members of local partner Masada Waste Management on biogas and on-site waste management. Youth groups responsible for the waste collection in Freetown participated in the training to create awareness around food waste valorization.

2023: Placement of second Waste Transformer through UNOPS in slum area in Freetown.

2024: Climate Fund Managers (CFM) project financier for financing 40 Waste Transformers in Freetown Sierra Leone. Next 4 installations will be placed in Freetown this year (Q1 and Q2).

2024: An on-site and online awareness campaign is developed and rolled-out in Freetown, to create awareness at each Waste Transformer site, to reduce the amount of food waste produced and to be able to collect clean streams of food waste from the neighborhood and businesses in Freetown.

Onwards: Further roll-out of the model, to build a blueprint for African megacities to process food waste in a decentralized way.

Monitoring and evaluation: Each Waste Transformer has 50 measurement points, which are monitored and saved every minute. In this way, the processes are monitored from a distance by The Waste Transformers technical staff in the Netherlands. The digestate (fertilizer) produced is examined and researched to optimize the usage as natural fertilizer. This is in the research phase in Freetown.

# Outcomes and Impact

Through persistent efforts, resilience, and the conquering of challenges posed by distance and harsh environmental conditions, local informal youth groups in Freetown have successfully gathered food waste and utilized it in the Waste Transformer, which powers the female hospital. The significance of this solution lies in its potential for replication. The ability to expand this initiative with the financial backing of Climate Fund Managers demonstrates the determination of teams both in the Netherlands and in Freetown.

By mid-2024, six Waste Transformer biodigesters will be operational in Freetown. Four of these biodigesters will process approximately 2,000 kilograms of food waste each per day, while the remaining two will handle around 350 kilograms per day. This initiative not only generates direct and indirect employment opportunities for locals involved in waste collection, sorting, and biodigester feeding but also stimulates job creation within the waste value chain. The organic fertilizer produced from the food waste offers numerous benefits for smallholder farmers, including soil health restoration, enhanced water retention, and increased crop yields, thereby improving their income prospects. The practice of on-site food waste valorization, which yields local clean energy and natural fertilizer while diverting waste from landfills, promises lasting effects on Freetown's communities, particularly those residing near landfill sites. Since a significant portion of landfill waste comprises organics, diverting food waste diminishes landfill pressure, reduces methane emissions, and mitigates the odor and air pollution emanating from these areas. This decentralized model aims to serve as a blueprint for other African megacities grappling with similar waste management challenges as Freetown.



## 350 kilograms per

Six operational biodigesters by mid-2024: Four of these biodigesters process around 2,000 kilograms of food waste per day, while the remaining two handle approximately 350 kilograms per day.

## Employment

Direct and indirect employment opportunities: The initiative generates jobs for locals involved in waste collection, sorting, biodigester feeding, and within the waste value chain.

## 38% reduction

Benefits of organic fertilizer: The organic fertilizer produced from food waste offers advantages for smallholder farmers, including soil health restoration, enhanced water retention, and increased crop yields, improving



# Replicability and Scaleability

The modular and containerized approach to on-site food waste valorization has been developed to be easily replicated and is being utilized in emerging and established economies alike. The system is constructed in the Netherlands and then transported to its final destination. Once on-site, the various containers are interconnected, and the feeding process can start. Thanks to online monitoring, technical expertise is not required to operate the system.

Various urban settings have proven to be suitable for the Waste Transformer biodigester, as evidenced by its successful operation at diverse locations such as a Dutch football stadium, a shopping mall, a slum in Freetown, and a waste processing site in Portugal. The primary takeaways are as follows: Many individuals are unaware of the significant environmental impact of food waste sent to landfills, where it generates substantial amounts of methane, contributing to global heating. However, with the proximity of on-site solutions, people become more aware of this issue, leading to improved separation of food waste streams and decreased overall food waste volumes.

For businesses, the on-site solution represents a tangible tool for sharing sustainability stories, actions, and opportunities. It is not merely a single-issue solution; rather, it promotes clean energy generation, waste segregation, utilization of natural fertilizers, and reduction of food waste.

# Inclusion and Innovation

The Waste Transformers biodigesters in Freetown demonstrates both inclusivity and innovation in its approach to on-site food waste management.

Firstly, the project shows strong evidence of engagement with various stakeholders and partnerships, particularly at the local level. Local informal youth groups play a pivotal role in collecting food waste and collaborating with the Waste Transformers team. Additionally, partnerships with Climate Fund Managers showcase collaboration on a broader scale, indicating a concerted effort to address food waste management challenges in Freetown.

Secondly, the initiative employs innovative methods to engage and involve community members throughout the planning, implementation, and follow-up processes. Mobilizing local youth groups not only empowers them but also ensures community ownership and participation in food waste management efforts.

# Accountability and Sustainability

'Operating in foreign countries exposes organizations to various risks, including cultural communication differences and local infrastructural challenges such as power cuts and training local staff for waste sorting and feeding. To overcome these hurdles, the team dedicated significant time to train local operators responsible for feeding and operating the biodigester. These operations are closely monitored from a distance by technical staff based in the Netherlands.

To ensure efficiency and effectiveness, the system employs a rigorous monitoring process. It captures 50 data points per minute, ranging from waste quantities fed to biogas quality production. This comprehensive monitoring enables the technical team to steer the bioprocesses effectively and provides timely feedback to on-the-ground operators, allowing them to adjust processes as necessary. This approach not only enhances operational efficiency but also ensures the smooth functioning of the biodigester system despite challenges posed by local conditions.

---

## Financial Data

After conducting a feasibility study in 2016, the Waste Transformers successfully secured various forms of governmental support from organizations such as RVO, NUFFIC, and DEG. This financial backing facilitated the feasibility study, the installation of the first biodigester in Freetown, and the training of local staff. The external support for this initial project amounted to EUR 318,000.

The Waste Transformers allocated multiple staff members with diverse expertise to ensure the project's success. This team included biogas experts, trainers for capacity building in Freetown, and individuals specializing in storytelling to raise awareness and garner support.

With the expansion of the initiative to serve as a blueprint for African megacities, a Special Purpose Vehicle (SPV) was established. This entity facilitated agreements such as power purchase agreements, fertilizer offtake contracts, and online monitoring agreements. These agreements ensure that data is systematically collected from all operational biodigesters, enabling continuous data generation and processing. This data-driven approach allows for ongoing optimization of the different systems, ultimately enhancing their efficiency and effectiveness.

# Contact

UN Secretary-General's Advisory Board on Zero:  
[advisoryboardzerowaste@un.org](mailto:advisoryboardzerowaste@un.org)

Email: [coen.bakker@thewastetransformers.com](mailto:coen.bakker@thewastetransformers.com)

Website: [thewastetransformers.com/projects-development/freetown-sierra-leone/](http://thewastetransformers.com/projects-development/freetown-sierra-leone/)

LinkedIn: [/company/the-waste-transformers](https://www.linkedin.com/company/the-waste-transformers)

Instagram: [/the\\_wastetransformers](https://www.instagram.com/the_wastetransformers)

Youtube: [/watch?v=\\_r9BV21aR2k](https://www.youtube.com/watch?v=_r9BV21aR2k)