Ministry of
Health, Environment and Nature

Developing a Sustainable, Circular and Resilient Solid Waste Management Structure for Curaçao

Index

TRANSFORMING WASTETOVALUE

resembid

Funded by the European Union
Financé par l'Union européenne

RÉPUBLIQUE FRANÇAISE

EXPERTISE FRANCE
GROUPE AFD

Implemented by Expertise France
Mis en œuvre par Expertise France

GFDRR | THE WORLD BANK

In collaboration with GFDRR
En collaboration avec le GFDRR

SUPPORTED BY RESEMBID FUNDED BY THE EUROPEAN UNION AND IMPLEMENTED BY EXPERTISE FRANCE

Foreword

"The Malpais Landfill will reach its capacity within 10 years - alternative waste processing methods must be implemented in the future."

In today's fast-paced and consumer-driven world, waste has become an inevitable byproduct of our daily lives. From plastic packaging to yard waste, we generate significant amounts of waste each day without genuinely taking into consideration its environmental and health impacts.

However, with the growing global and local awareness of environmental issues and the need for sustainable solutions, now is the time to shift towards more sustainable waste management. Sustainable waste management is a comprehensive approach that aims to reduce the environmental and health impacts of waste by implementing sustainable solutions throughout its life-cycle. This includes preventing/reducing waste produced, reusing materials whenever possible, and recycling waste to conserve resources to avoid waste being landfilled. Because that is another imminent challenge for Curaçao: the Malpais Landfill will reach its capacity within 10 years. So, alternative waste processing methods must be implemented in the future.

With the implementation of the EU funded project "**Transforming Waste to Value: Developing a Sustainable, Circular and Resilient Solid Waste Management Structure for Curaçao**", Selikor N.V. has taken another important step towards sustainable waste management on Curaçao. As part of this project a number of important studies were conducted.

Firstly, a **Waste Characterization Study** was needed to gather the necessary data on the volumes and composition of waste generated on the island. Using this data, a **Feasibility Study** to determine the most appropriate future **waste processing options** (WPOs) for Curaçao was carried out simultaneously with an **Environmental/Location Study** to determine for these WPOs the most suitable location(s) on Curaçao that have the least environmental impact.

To incorporate the results and recommendations of the above studies and to transition towards more sustainable, circular waste processing, a new National Waste Management Policy was also drafted.

"Now is the time to shift towards more sustainable waste management."

Wesley Kook
Director Selikor

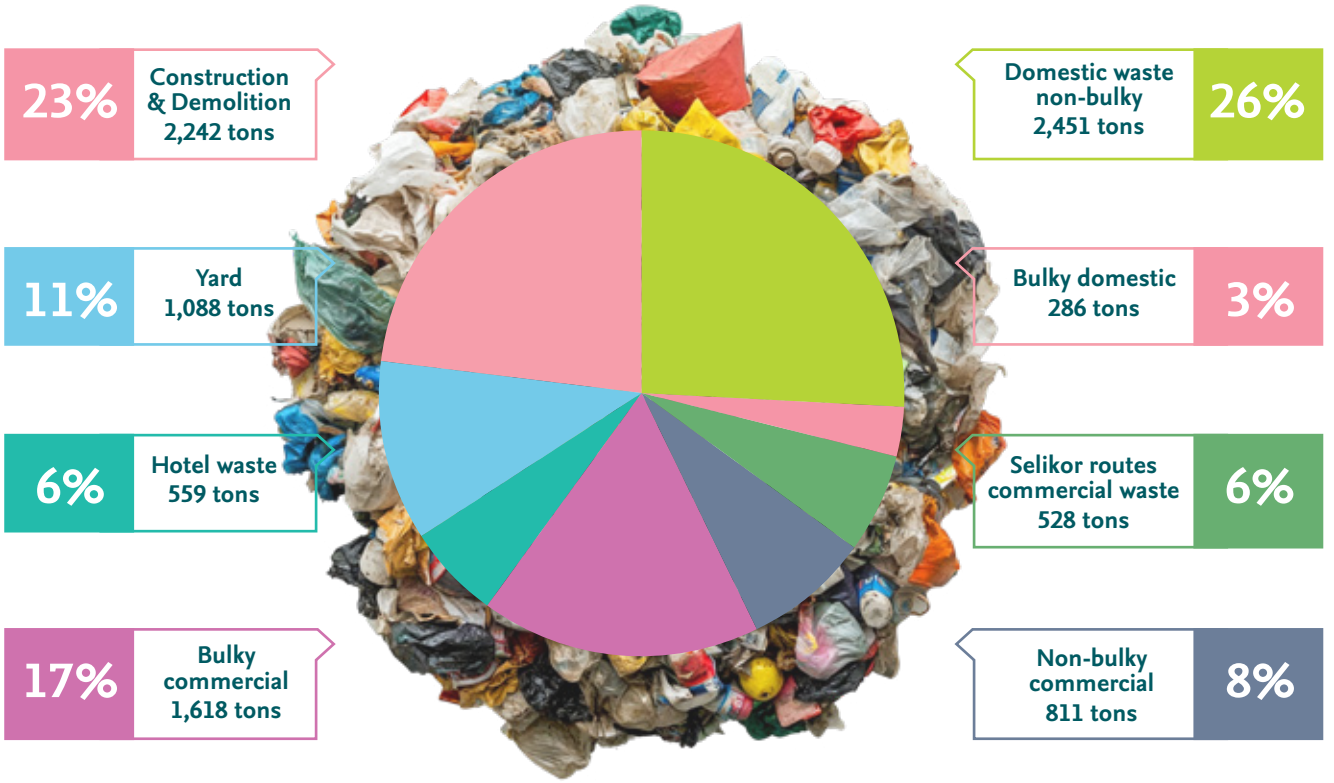
APRIL 2024

Results of the Waste Characterization Study (WCS)

Curaçao generates approximately 210,000 metric tons of solid waste per year, a figure that underscores the pressing need for improved waste management strategies. Of this total, over the past 10 years an average of 130,000 tons/year has been brought to the Malpais Landfill, while the remaining 83,000 tons are either processed for recycling or stored for potential future recycling. Illegal dumping remains a major issue, estimated at 10,000 tons annually.

Download the full Waste Characterization Study here:

26%	23%	17%	11%	6%	
non-bulky domestic waste	construction & demolition (C&D) waste	bulky commercial waste	yard waste	hotel waste	Other categories include bulky domestic waste and various commercial waste types.



LANDFILLED WASTE COMPOSITION

"The key challenge is implementing an efficient collection and sorting infrastructure, as well as creating incentives for individuals and businesses to participate in recycling programs."

Sampling and sorting campaign

During the 8-week sampling and sorted campaign, 239 samples were taken and sorting by hand into 26 separate waste fractions (such as organic waste, construction & demolition waste, paper, glass, PET plastic, metals, wood, etc.).

Recycling and Waste Diversion Potential

These figures suggest that a substantial fraction of the waste currently being landfilled consists of materials that could potentially be diverted through more efficient recycling, composting, or repurposing efforts. Organic waste, paper and cardboard, and plastics collectively make up **58% of non-bulky waste**, presenting an opportunity for enhanced waste sorting and processing. In total, there are **32,575 tons/year** of organic waste **that could be composted** and **23,200 tons/year of construction & demolition materials waste that could be recycled**.

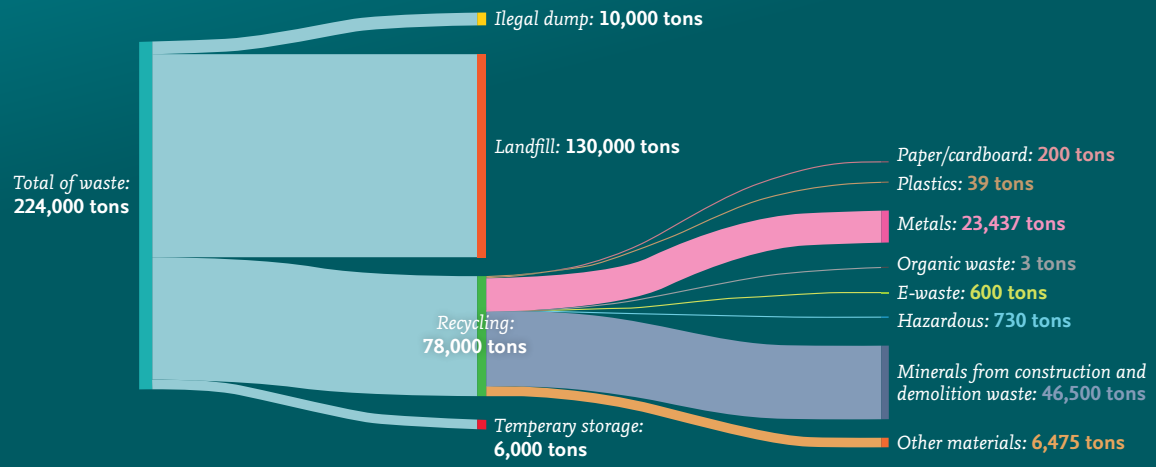
In contrast to the waste that reaches the landfill, approximately **78,000 metric tons of waste are currently processed by private recyclers**. The vast majority of this consists of metals and concrete, while an additional **5,600 metric tons** - primarily concrete - are stored for future recycling.

However, the study found that recycling rates for plastics remain low, with **only 39 tons of plastic being recycled per year**, though this figure is expected to **quadruple** in the coming years with the expansion of existing programs. Similarly, **paper and cardboard recycling is currently limited to 200 tons per year, while aluminum can recycling accounts for just 4 tons annually**. The key challenge is **implementing an efficient collection and sorting infrastructure**, as well as creating incentives for individuals and businesses to participate in recycling programs.

Waste-to-Energy (WtE) Feasibility

Based on current waste composition, it was determined that **106,000 tons of waste could be used as fuel for an incineration-based energy recovery system**. However, the study also highlighted concerns regarding the energy efficiency of such a facility, given that the **average lower heating value (LHV) of the waste stream is 7.6 MJ/kg** - a relatively low value when compared to other WtE systems worldwide. While this level is sufficient for incineration, it would require additional optimization measures to ensure long-term viability.

MASS BALANCE



39% of the waste is recycled or exported for recycling

Results of the Feasibility Study to determine the Best Waste Prosessing Options

A comprehensive Feasibility Study was conducted to determine the most effective waste processing options. The study investigated options to **reduce the negative ecological and social impacts of waste disposal, explored the feasibility of waste-to-energy (WTE) solutions, and established a roadmap for a more circular waste management system.**

At present, waste management on the island relies heavily on landfilling, with some recycling and composting initiatives led by private businesses. However, without structured policies or strong incentives, these efforts remain fragmented.

Furthermore, the gate fee for landfill disposal, **set at ANG 30 per ton since 1996**, has never been adjusted for inflation, effectively subsidizing landfilling and discouraging investment in alternative waste processing solutions. This has only become exacerbated now that the government has decided to pay all landfilling disposal fees until the end of 2025 resulting in 'free' landfilling for waste generators.

Waste Processing Options (WPOs) Considered

The study assessed different WPOs using a **multi-criteria analysis (MCA)**, including technical, financial, and environmental feasibility and identified four that have the most potential to reduce the amount of waste being landfilled.

"Four waste processing options have been identified as having the highest potential to reduce environmental and social impacts. These options form the foundation for a roadmap towards a more circular and sustainable waste management system."

Option 1: Waste-to-Energy (WtE)

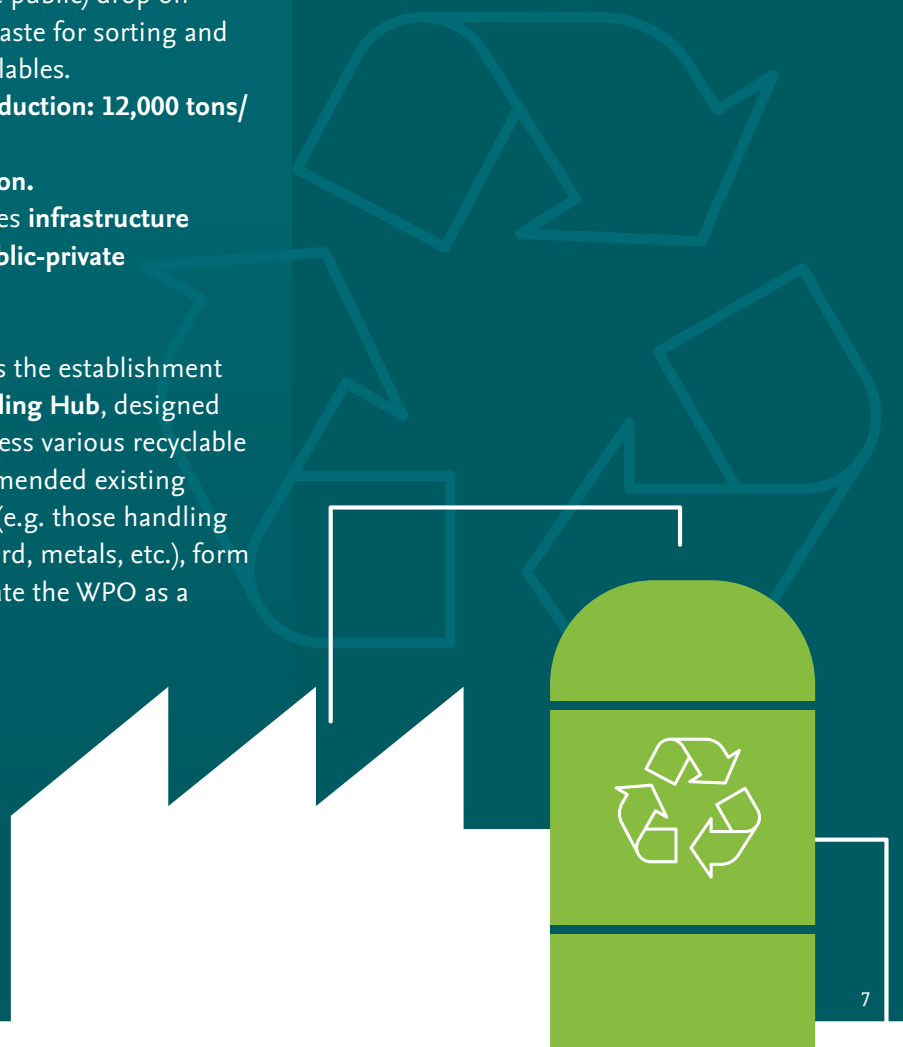
- A facility that incinerates combustible solid waste to generate electricity.
- **Potential landfill reduction: 76,000 tons/ year.**
- **High cost: ANG 298 per ton.**
- **Challenges:** High **capital and operational costs**; requires **government support** and a **guaranteed energy buyer (e.g., Aqualectra).**

One of the most discussed solutions is a **WtE facility**, which involves the incineration of solid wastes waste to generate between 6.2 - 7.5 MW of electricity. The financial analysis shows that revenues from electricity generation alone would be insufficient to cover operational and capital costs, meaning that government subsidies or increased gate fees would be necessary to sustain such a facility.

Option 2: Industrial Recycling Hub

- A centrally located facility where businesses (and the public) drop off different types of waste for sorting and processing of recyclables.
- **Potential landfill reduction: 12,000 tons/ year.**
- **Cost: ANG 52 per ton.**
- **Challenges:** Requires **infrastructure investment** and **public-private partnerships**.

Another viable WPO is the establishment of an **Industrial Recycling Hub**, designed to centralize and process various recyclable materials. It is recommended existing recycling companies, (e.g. those handling plastic, paper/cardboard, metals, etc.), form a cooperative to operate the WPO as a single entity.



Option 3: Construction & Demolition (C&D) Waste Pre-Sorting

- A facility where businesses (construction companies in particular) drop off C&D waste for sorting to recover materials such as sand and gravel.
- **Potential landfill reduction: 10,000 tons/year.**
- **Cost: ANG 25 per ton**.
- **Challenges: legislative support for mandatory sorting is needed.**

Recycling of C&D waste already occurs on Curacao, however to increase the amount being recycled, **pre-sorting of C&D waste** would allow for the recovery of a much greater amount of materials such as gravel, sand, and reusable building components. By implementing better sorting mechanisms to remove contaminants, a large volume of 'clean' C&D waste would be available for recycling. However, for this to be effective, legislation mandating sorting at the source (e.g. for demolition/renovation projects) would need to be enacted and enforced.

Option 4: Composting & Chipping

- A facility where businesses (and the public) drop off **organic waste to be processed into compost and wood chips**.
- **Potential landfill reduction: 18,000 tons/year**.
- **Cost: Positive business case** (profitability anticipated).
- **Challenges:** Requires **public engagement and proper source separation**.

Among the most immediately feasible options is **composting and chipping of organic waste**, producing products to be sold locally generating a **positive financial return**, replacing imported compost, potting soil and mulch. Composting would require minimal infrastructure changes and could be implemented relatively quickly, but its success depends on public participation in waste separation.

Landfill fees must be increased, or financial subsidies must be introduced

Introduce a tourism-based waste tax

Financial and Environmental Considerations

The study highlights that the true cost of landfilling is significantly higher than what is currently accounted for. Factoring in environmental degradation, lost tourism revenue, and social costs, landfilling is estimated to cost Curaçao **between ANG 80-100 per ton**. By contrast, alternatives such as composting, recycling, and C&D sorting present more sustainable financial models.

However, for these alternatives to succeed, the financial structure of waste management must change. Currently, **the low landfill fee discourages waste diversion**. The study suggests that either **landfill fees must increase, or alternative waste processing initiatives must receive financial subsidies**. One proposed solution is a **tourism-based waste tax**, which could be applied per tourist night or per ton of imported goods to help finance waste reduction efforts.

Results of the Environmental / Location Study for New Waste Processing Options

This study assessed and evaluated the most suitable sites for the implementation of the four waste processing options (WPOs) identified in the Feasibility Study:

Waste-to-Energy (WtE)
Incinerates municipal solid waste to generate energy.

Construction & Demolition (C&D) Waste Recycling
Processes C&D waste to recover materials or use in local construction.

Composting Facility
Converts organic waste into compost.

Industrial Recycling Hub
A centralized facility for commercial recycling activities.

Each of these WPOs was assessed based on **environmental, logistical, and infrastructural considerations**:

- **Land Availability** (e.g., land use zoning, availability, safety).
- **Environmental Criteria** (e.g., air quality, noise, nature impact).
- **Logistical Considerations** (e.g., proximity to waste sources, road access).

Waste-to-Energy
The study identified several possible locations for a WtE facility, including **Malpais, Bullenbaai, Meiberg, Van Leer, Isla East, and Asphalt Lake**. Each site was evaluated for factors such as air quality impact, traffic congestion due to waste transportation, and proximity to urban areas. While Malpais and Bullenbaai were among the most promising candidates, concerns about emissions and potential health risks in densely populated areas necessitate additional environmental impact assessments. **Logistically there would be** over **100 trucks per day**, creating traffic impacts.

C&D Waste Recycling
C&D Recycling should be centralized near construction activity zones. Preferred locations for this facility include **Meiberg, Malpais, Brievengat, the Asphalt Lake, and Manzaliña Bay**. The study emphasized that while the process is relatively low-cost, proper dust and noise control measures must be implemented to mitigate environmental concerns.

Composting Facility
Another critical aspect of sustainable waste management in Curaçao is **organic waste processing**, particularly through composting. Composting offers a relatively low-cost solution with environmental benefits, such as **soil enrichment**. The study identified **Aloë Farm, Klein Kwartier, Soltuna/De Savaan, and Ronde Klip** as the most suitable sites for composting facilities. However, odor control and moisture management would be crucial for its success, particularly in locations near residential areas. **Traffic impact** is lower than for the other identified WPO facilities.

Industrial Recycling Hub

The study identified **Isla West, Asphalt Lake, and Buskabaai North** as the most promising potential locations. Since most of the recyclables processed at this hub would be destined for international markets, proximity to the container port is essential. This is a light industrial activity with minor environmental concerns.

The location of the Industrial Recycling Hub should be **centrally located**, as close as possible to the existing recycling companies.

Climate Change and Greenhouse Gas (GHG) Considerations

- **A baseline emissions assessment** was conducted.
- **WtE can offset some fossil fuel emissions**, but the **plant would emit CO, NOx, SO, and particulates** and **dioxins** and **heavy metals** remain a concern.
- **Composting and recycling reduce landfill methane emissions**, contributing to **climate goals**.
- The location must also be resilient to climate change. Vulnerable sites, especially industrial sites around Schottegat Bay may require land elevation.

Download the full Environmental/ Location Study here **here:**

C&D Waste Recycling

1 Heavy Mix Concrete
2 Buskabaai
3 Mijnmaatschappij
4 CRC

Lead-Acid Batteries

5 ZAP Batteries
6 NAPA
7 Power Distribution (MAC)
8 Cur. Waste Management

Plastics

9 Green Force
10 Green Phenix
11 Limpi

Paper/Cardboard

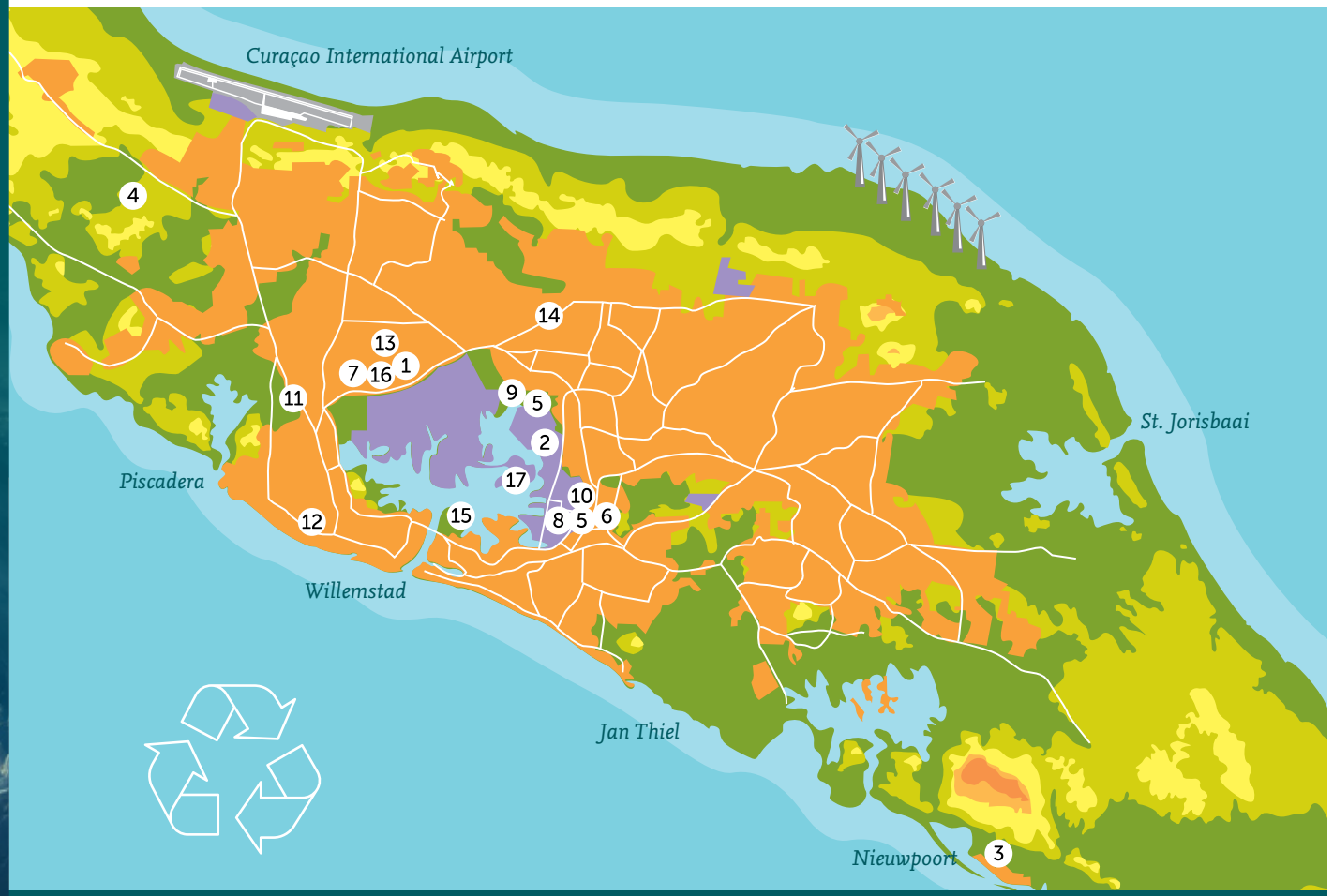
12 Paradise Recycling
13 Van Rumpt Recycling
14 Shred Express

Scrap/ Metals

15 Antillean Scrap Comp.
16 ENI-environment (+cardboard)

Cooking Oil

17 Energis



EXISTING RECYCLING COMPANIES ON CURAÇAO

Conclusions and recommendations

"Early intervention is key to avoiding a future waste crisis."

Curaçao stands at a critical juncture in its approach to waste management. With landfill capacity reaching its limits and waste generation expected to increase, a shift toward more sustainable waste processing is imperative.

By implementing enhanced recycling programs, optimizing collection systems, and exploring alternative waste processing solutions such as composting and WtE, Curaçao has the potential to significantly reduce its landfill dependency while improving environmental sustainability.

Early intervention is key to avoiding a future waste crisis. With the right combination of policy changes, infrastructure investments, and community engagement, Curaçao can move towards a more sustainable and efficient waste management system that benefits both the environment and the local economy. Policymakers must take proactive steps to improve waste management infrastructure, rather than waiting for landfill capacity to become critically constrained.

There is a **clear need for greater investment in waste sorting, recycling, and alternative waste processing options**. There is significant **untapped potential in the recycling sector**, particularly for organic waste, C&D waste, plastics and paper/cardboard, so **expanding recycling initiatives should be a top priority**. Improving waste diversion strategies will **substantially reduce the burden on the landfill**, while also creating economic opportunities in the recycling industry.

Optimizing the waste collection and sorting infrastructure, particularly for **commercial and hotel waste streams**, which contain high levels of recyclable materials is necessary. Waste prevention and **circular economy strategies** must be promoted to reduce overall waste production. This could be achieved through a combination of **policy incentives, public awareness campaigns, and improved collection systems**.

Among the options evaluated, **a phased approach would be optimal**; a combination of **maximizing recycling efforts and implementing a small-scale WtE facility**. However, given current financial constraints, it is advised in the short term to **first prioritize C&D sorting, composting, and industrial recycling**, while laying the groundwork for a future WtE project. These three options should be prioritized, as they require lower investments and offer immediate benefits. Developing local markets for recycled construction materials and compost will be essential for ensuring the economic sustainability of these initiatives.

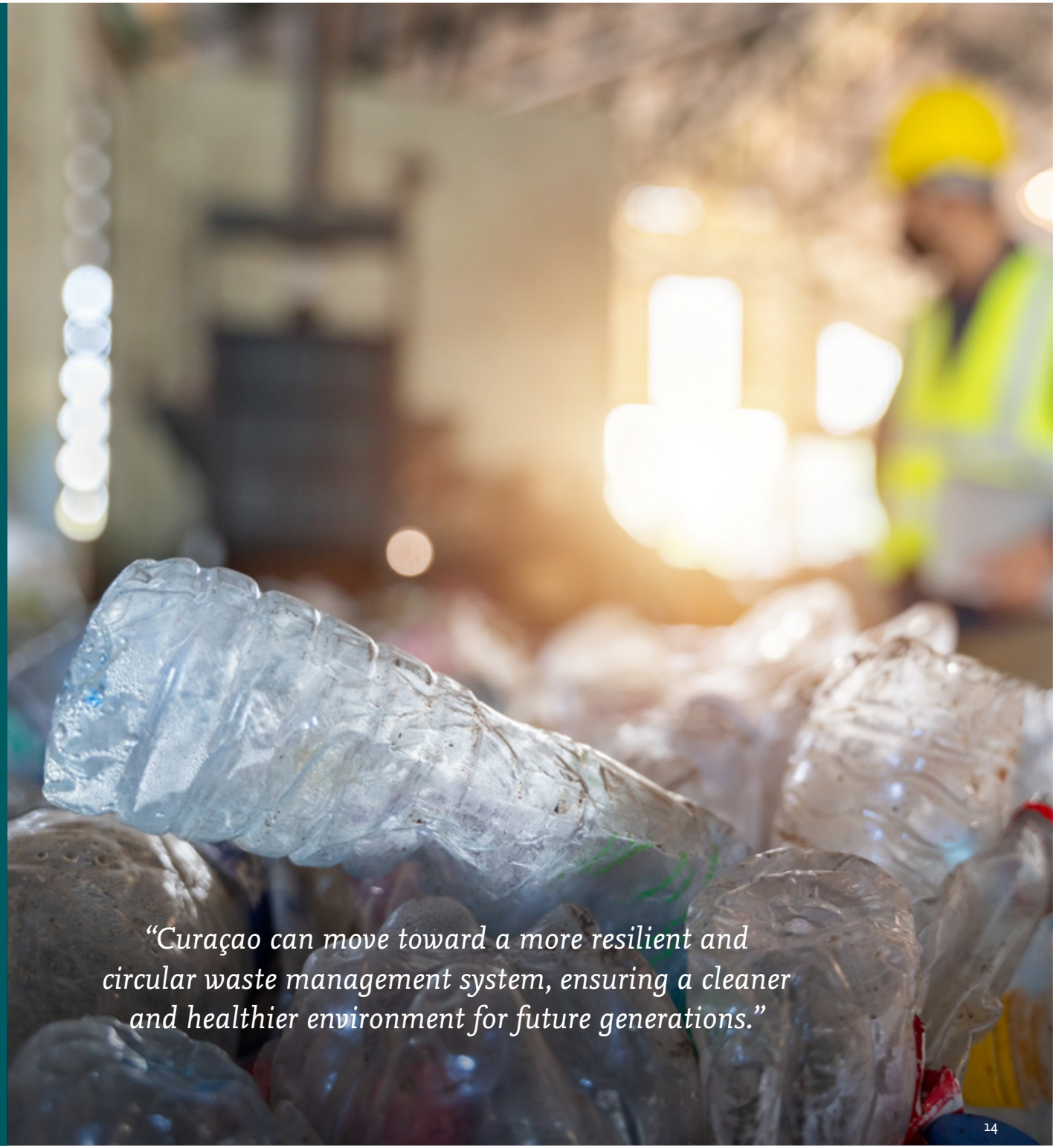
"With landfill capacity reaching its limits and waste generation expected to increase, a shift toward more sustainable waste processing is imperative."

61%
of all collected waste in Curaçao is landfilled at Malpais

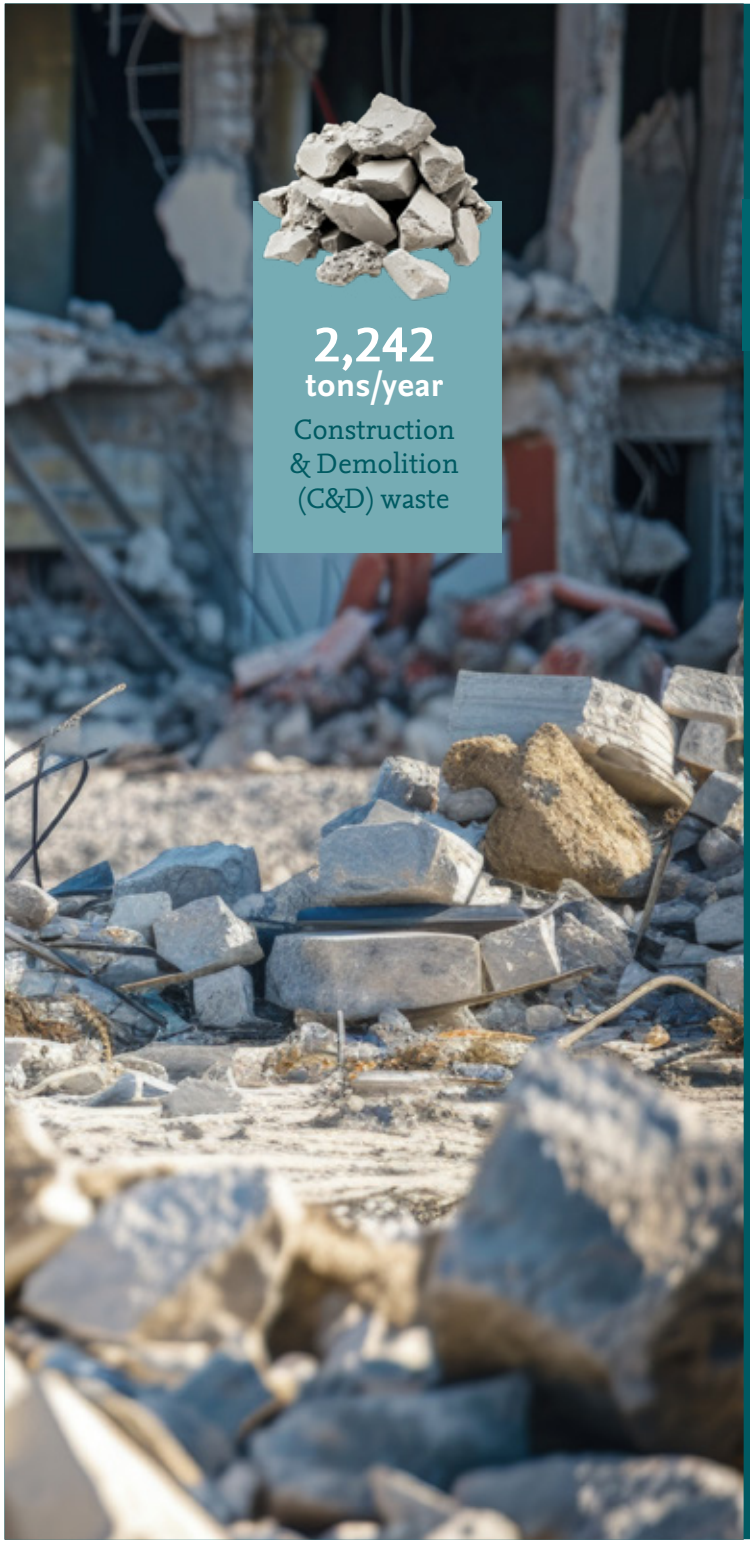
The success of an **Industrial Recycling Hub** would depend on its integration into the existing waste collection infrastructure, as well as regulatory support to incentivize businesses to participate in recycling programs.

To support these initiatives, exploring **public-private partnerships (PPPs), financial incentives for recycling, and regulatory measures to encourage waste diversion** are recommended. In terms of funding, the government should **explore partnerships with development banks and climate funds**.

While WtE remains a **potential long-term solution**, further feasibility assessments are needed to determine its economic and environmental viability. Additionally, given that even the most advanced WtE systems would **still require landfilling for residual waste and ash**, policymakers must consider **long-term landfill expansion** in parallel with WtE planning. However, before moving forward with WtE, it is crucial to establish a **comprehensive regulatory framework** to manage emissions, ensure public health safety, and secure sustainable funding. Negotiating a **long-term electricity purchase agreement with Aqualectra** at competitive rates is also necessary to support future WtE projects.



"Curaçao can move toward a more resilient and circular waste management system, ensuring a cleaner and healthier environment for future generations."



2,242
tons/year
Construction & Demolition (C&D) waste

"Critical Factors for Change."

For these alternatives to succeed, the financial structure of waste management must change. Currently, the **low landfill fee discourages waste diversion.**

Landfilling fees must increase and be adjusted to reflect actual disposal costs, or **alternative waste processing initiatives must receive financial subsidies**. Without this, landfilling will continue to be the cheapest and most convenient option, undermining efforts to increase recycling and waste recovery.

To facilitate implementation, **policy adjustments are needed** to encourage recycling and waste processing. These should include **tax incentives for recycling businesses, mandatory waste separation for companies**, strictly regulating illegal dumping, and enforcing penalties to deter non-compliance.

Beyond policy measures, to ensure the success of the recommended initiatives, **community engagement will be crucial. Public awareness and education campaigns** focusing on increasing public awareness of **waste separation at the source, the benefits of recycling, and the long-term environmental impact of waste mismanagement** are essential to increase recycling rates and ensuring the success of recycling and composting programs.

By adopting a phased approach that prioritizes sustainable and cost-effective solutions, Curaçao can move toward a more resilient and circular waste management system, ensuring a cleaner and healthier environment for future generations.

Eye on the Future:

Small Efforts, Sustainable Impact

Esfuerso Chikí, Impakto Duradero

Start making a difference today! Even small efforts have a long lasting sustainable impact.

Reduce:
Do you really need it?
Reduce the amount of waste you produce! Avoid impulse buying - think really hard before deciding to purchase something. Also refuse single use plastics.'

Reuse:
Are you sure it's waste?
If you or someone else can reuse it, don't throw it away!

Recycle:
Give waste a new life.
Did you know you can recycle more than 18 different types of waste on Curaçao? Want to know more about recycling? About what you can recycle and how/ where you can recycle?

Redusí
Reusá
Resiklá
koRRRsou.com

Find out more about the 3 Rs on Curaçao. Check these out:

www.korrrsou.com

www.youtube.com/@korrrsou

www.tiktok.com/@korrrsou

www.facebook.com/korrrsou

www.instagram.com/korrrsou

Calling all entrepreneurs and young professionals!

Did you know that more than 20 companies are in the recycling business on Curaçao?

Have your own idea on how to transform waste into value?

Learn about current and future business opportunities in the circular economy.

Join the sustainable waste management revolution on Curaçao today to create a cleaner and healthier island!

Ministry of
Health, Environment and Nature

This publication was funded/co-funded by the European Union. Its contents are the sole responsibility of Selikor NV and the Ministry of Health, Environment and Nature and do not necessarily reflect the views of the European Union.

TRANSFORMING WASTE TO VALUE

Design, data visualization: I-Design N.V.

SELIKOR
ISO 9001 • ISO 14001
Huntu nos a logr'é

SELIKOR NV • Parera z/n, P.O. Box 3586, Curaçao, Dutch Caribbean • Tel.: (+5999) 434-1300 • Mail: info@selikor.com