Interreg NEXT Black Sea Basin

Co-funded by the European Union

WISE WASTE

WISE-WASTE Project: Digital Brochure

A Digital Guide to Best Practices and Integrated Solutions in Waste Management



Introduction

This Digital Brochure has been developed under the framework of the WISE-WASTE Project, funded by the Interreg NEXT Black Sea Basin Programme. As local service providers, regional utility operators, and municipal sanitation departments, you are at the forefront of a critical ecological transition. Managing municipal waste is no longer just about collection and disposal, it is about transforming data into efficiency and waste into secondary resources.

The primary objective of this handbook is to provide a highly practical, ready to implement digital guide. By combining advanced Internet of Things (IoT) technologies with localized biological recovery and structured public-private alliances, this document bridges the gap between high-level environmental policies and daily field operations.

Cross-Border Synergy: One Framework, Four Unique Regions

The strength of the WISE-WASTE initiative lies in its diverse, transnational partnership. While this architecture provides a standardized framework, its implementation is dynamically tailored to the distinct operational realities of our partner regions:



Municipality of Nessebar (Bulgaria) & Thessaloniki Region (Greece)

Dual focus on mitigating extreme seasonal waste surges, optimizing coastal logistics, and intercepting commercial packaging from massive hospitality/tourism networks.



Kutaisi (Georgia) & Kırklareli (Turkey)

Focus on institutionalizing regional organic waste diversion, establishing municipal composting loops, and streamlining urban-industrial waste collection baselines.

By unifying our key performance indicators (KPIs) and deploying open-source, vendor-neutral technologies, we ensure that the progress made in Nessebar serves as a scalable, transparent benchmark across the entire Black Sea Basin.

Chapter 1: The Smart Container Manual (IoT Deployment)

Selection Rules for Ultrasonic Sensors

Frequency Range

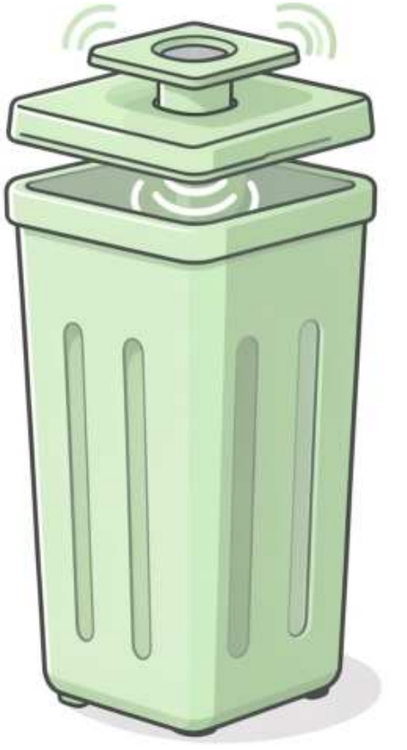
Utilize sensors operating between **40 kHz and 65 kHz** for optimal detection in enclosed container spaces.

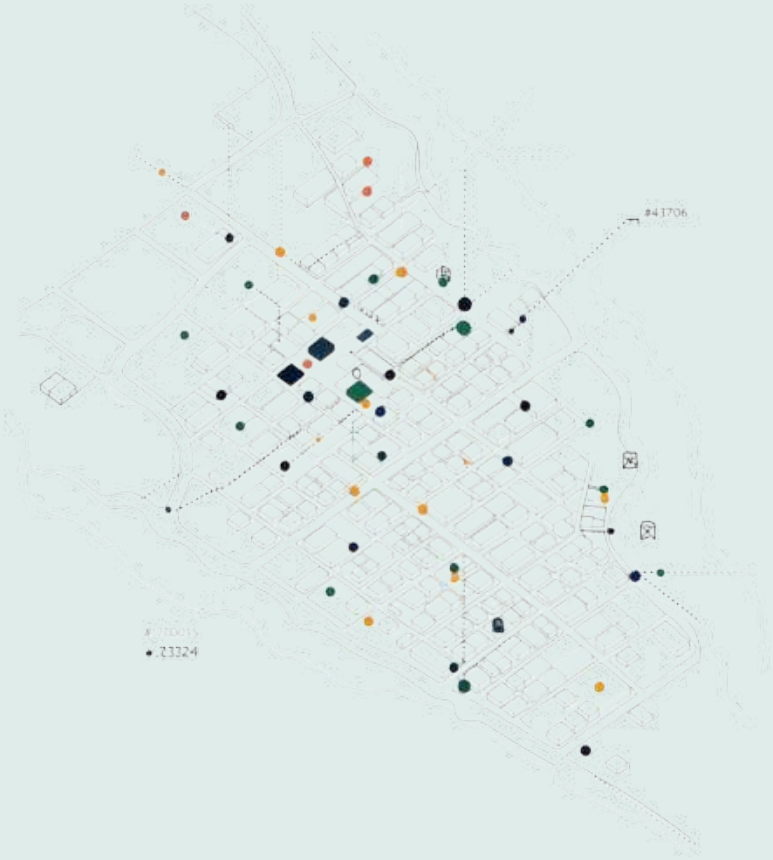
Ingress Protection

Minimum **IP67/IP68 rating** to ensure strict resistance against moisture, dust, and corrosive leachate.

Measurement Range

Effective operational depth calibrated from **10 cm up to 250 cm** from the container lip.





Sensor Placement Strategies (Differentiated Approach)

High-Variance Volatile Tourist Spots

Nessebar, Thessaloniki

- 100% sensor coverage across historical districts, beach promenades, and major hotel cluster zones.
- Data transmission frequency: Configured to every **30–60 minutes** during peak summer tourism surges.

Uniform Baseline Loading Zones

Kırklareli, Kutaisi

- Partial deployment (**20–30% representative sampling**) across stable residential and industrial sectors.
- Data transmission frequency: Reduced to **2–4 times per day** to maximize hardware lifespan and conserve battery.

Specifications to Prevent Proprietary Vendor Lock-in

Connectivity

Strictly utilize open, standard networks such as **LoRaWAN, NB-IoT, or LTE-M**.

Battery Lifespan

Minimum **5–7 years** under standard operational profiles, utilizing Lithium Thionyl Chloride ($Li\text{-}SOCl_2$) cells.

Data Export

Mandatory support for open APIs (**JSON/XML formats**) and MQTT protocols to enable seamless integration into any municipal GIS platform.



Chapter 2: Data-Driven Fleet Management (Logistics Optimization)

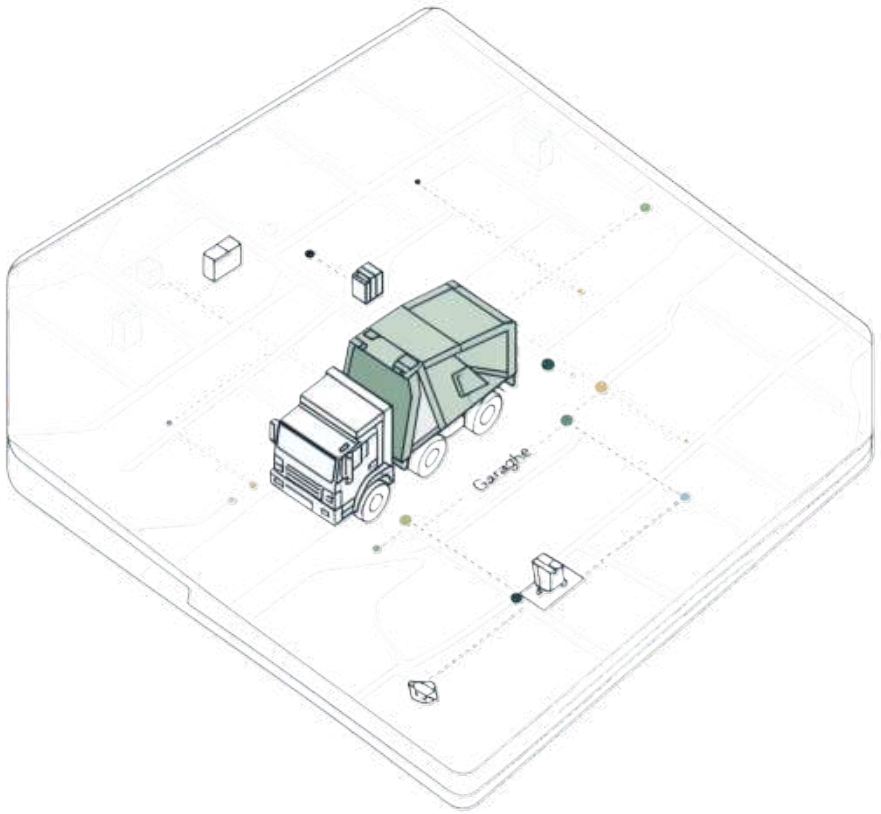
Transforming Passive GPS Loops into Active Optimization

1 **Real-Time Integration**

Feed automated data streams from container IoT sensors directly into the central routing software.

2 **Dynamic Dispatch Model**

Regenerate collection routes dynamically every single morning. Vehicles are dispatched only to containers exceeding a **75% fill-level threshold**.



Managing Summer Tourism Surges

- **Flexible Collection Shifts:** Implement a three-shift flexible schedule (including night and early morning routing) during peak seasons to bypass traffic congestion and high temperatures.

25%

Fuel & Mileage Savings

vs. baseline — dynamic routing impact

Chapter 3: Commercial and EPR Channel Operations (Packaging Interception)

Standardizing Agreements for Commercial Zones

Hotel Chains and Restaurants

Nessebar, Thessaloniki

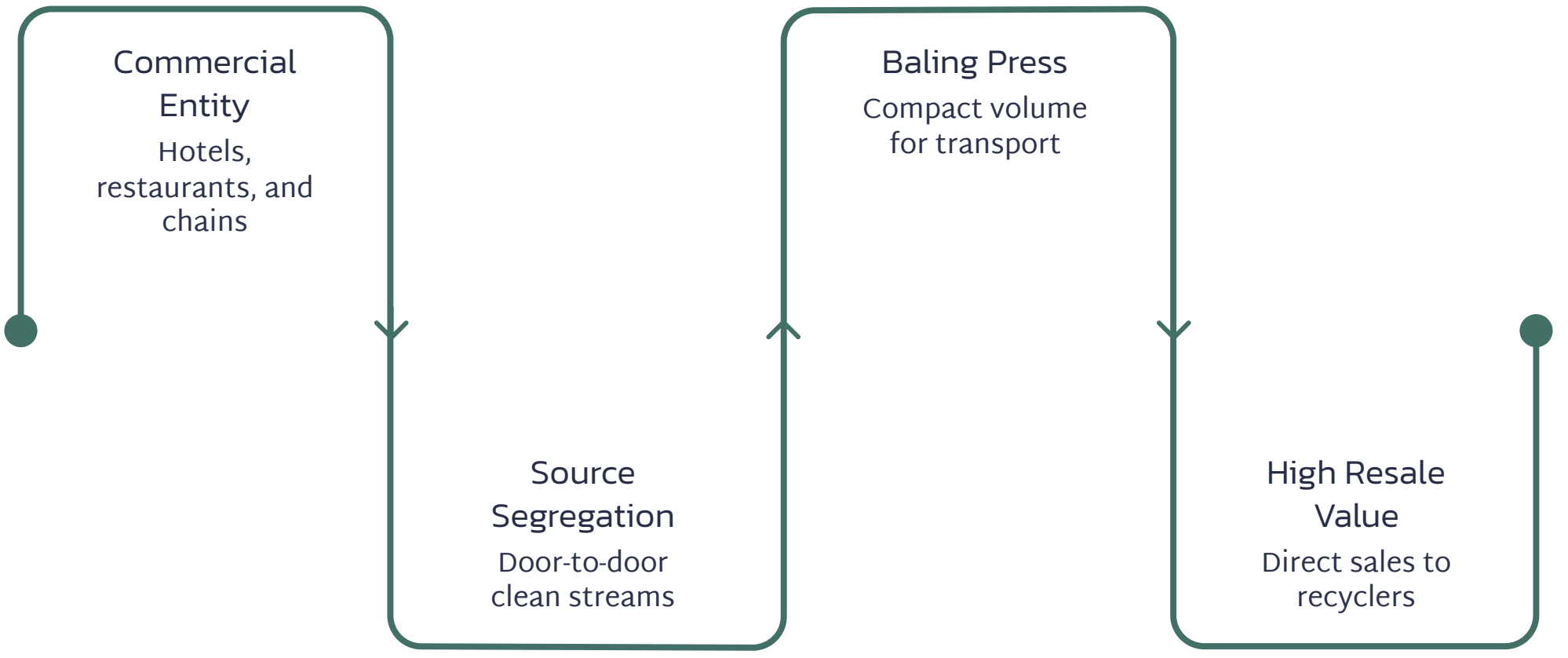
Establish mandatory door-to-door source-segregated collection schedules tailored to commercial hospitality hours.

Industrial and Retail Hubs

Kırklareli, Kutaisi

Standardize trade waste agreements offering preferential waste fee tariffs to businesses that pre-sort clean dry recyclables.

Maximizing Market Resale Value



Equipment Deployment: Install localized hydraulic baling presses at major retail zones, shopping malls, and distribution centers for cardboard, PET, and aluminum cans. Dense, compact baled materials minimize regional transport costs and secure premium pricing from secondary raw material markets.

Chapter 4: Localized Biological Recovery (Organic Diversion Protocols)

The Kutaisi Facility Model

Open-Air and Indoor Windrow Composting

- **Technology:** Deploy regional composting blueprints based on the Kutaisi facility configuration, blending indoor intensive decomposition (for odor capture) with open-air turned windrows.
- **Capacity:** Specially engineered to process green waste from public parks, gardens, and organic food waste diverted from large-scale hotel kitchens.

Decentralized Community and Backyard Loops

- **Rural and Suburban Sectors:** Implement localized distribution programs for home composting bins across residential municipalities.
- **Training Manuals:** Distribute clear instructional guides detailing optimal carbon-to-nitrogen ("brown" to "green") ratios to prevent anaerobic decay and odor issues.



Chapter 5: The Standardized Regional KPI Dashboard (Performance Auditing)

To audit and compare project milestones uniformly across Bulgaria, Greece, Georgia, and Turkey, all partners will report into a single unified dashboard using these core target indicators:

Metric Reporting Indicator (KPI)	Unit of Measurement	Core Target Objective
Annual Mass Volume Generated	Tons (t)	Tracks the absolute volume of waste diverted by stream.
Per Capita Index	kg/capita/year	Measures the long-term efficacy of municipal source reduction.
Container Overflow Events	Count / Month	Directly measures IoT sensor reliability and dispatch agility.
Separate Collection Capture Rate	% of Total Mass	Quantifies the percentage of recyclables successfully kept out of landfills.
Verified Fuel & Kilometer Savings	% reduction vs Baseline	Audits environmental and financial gains from dynamic routing.



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