

SOLUTIONS

**FOR REMOVING SPENT
BATTERIES AND SMALL WEEE
FROM RESIDUAL WASTE**

Technologies/Costs/Drivers

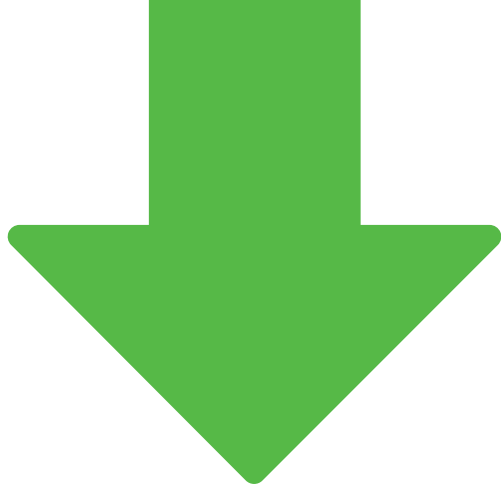
Erion Energy



**POLITECNICO
MILANO 1863**

DIPARTIMENTO
DI MECCANICA

Erion Weee



Too many small WEEE and spent batteries still end up in residual waste, where valuable resources are lost and treatment becomes more complex.

*Separating these materials from mixed residual waste is essential to **prevent the release of hazardous substances, recover critical raw materials**, improve safety at treatment facilities, and **strengthen the contribution of these value chains to the circular economy**.*

Addressing this technological challenge can create new opportunities to turn waste into valuable resources and support a more sustainable future.



The untapped potential of residual waste



According to Erion's 2025 study, significant quantities of small WEEE and spent batteries are still present in residual municipal waste: on average, **1.98 kg** per inhabitant per year of WEEE and **0.12 kg** per inhabitant per year of spent batteries. Harvesting these volumes would increase collection rates: **from 17% to 37%** for small WEEE and **from 25% to 52%** for portable batteries.

Separate collection remains the primary channel for collecting small WEEE and spent batteries from households. However, the available data suggests that complementary solutions should be explored to capture the volumes that still escape dedicated collection systems. One promising approach is to remove small WEEE and spent batteries from residual municipal waste by integrating dedicated technological solutions into **mechanical-biological treatment** (MBT) plants. As facilities in which residual municipal waste is concentrated and processed, MBT plants could serve as effective separation points for materials that are incorrectly disposed of by citizens.

MBT plants carry out a series of treatment operations on residual municipal waste, including separating the different material fractions in the waste, reducing its weight and volume, stabilising the organic component and producing output streams for further use or treatment. Downstream of MBT plants, residual waste can be sent for energy recovery, processed into solid recovered fuel or sent to landfill.

Case study: Ecologia Viterbo



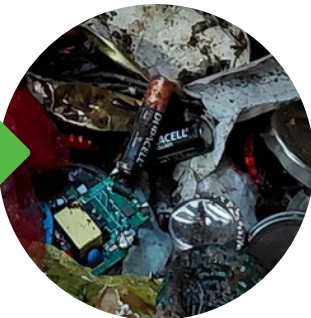
The study focuses on the use-case of , a MBT plant located in Casale, Viterbo.

The plant treats residual waste (municipal and non-hazardous special waste), producing solid recovered fuel, stabilised organic fraction and other streams destined for recovery or disposal. Its annual capacity is around 215,000 tonnes, with a treatment rate of around 50 tonnes/hour.

The treatment process involves an initial waste reception and primary shredding stage, followed by screening to separate the dry and wet fractions, as well as the recovery of ferrous and non-ferrous metals.

The dry fraction is refined through air separation: the light fraction is used to produce Solid Recovered Fuel, while the non-recoverable heavy fraction is sent for disposal. The wet fraction is biologically stabilised in aeration basins and subsequently screened to separate the Stabilised Organic Fraction from the refining rejects.

In the current process, one of the most critical stages is **primary shredding**: when lithium batteries, or other components that would require dedicated management, are damaged, they **can cause fires**, posing a **significant risk** to the overall safety of the plant.



The solutions



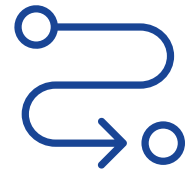
The three key stages for removing spent batteries and small WEEE from residual waste streams should be:

1 MATERIAL RECEPTION AND PREPARATION: opening bags without damaging their contents, using **low-speed bag-opening systems** to release the waste without crushing batteries or electronic devices;

2 INSPECTION AND IDENTIFICATION: the most promising technology has been identified as **X-ray transmission equipment**, which can scan through the material and detect batteries and small WEEE even in complex and contaminated streams;

3 SEPARATION AND REMOVAL: once identified, the target materials could be removed using manual methods, linear actuators, air jets or **robotic solutions**, the latter offering the highest precision.

Conclusions



The integration of dedicated systems for removing spent batteries and small WEEE into the operation of an MBT plant is technically feasible: the bag-opening, identification and separation technologies currently available make it possible to develop solutions capable of intercepting these streams even within complex and heterogeneous waste such as residual waste.

The main critical issue is not technical feasibility, but the **economic sustainability** of the investment. To avoid reducing the throughput of the plant under study, at least three parallel feeding lines would be required, entailing a particularly high investment, mainly due to the cost of X-ray identification systems. Considering these factors, the introduction of such technologies appears economically challenging. It may be appropriate to assess financing mechanisms, including public funding, to enhance the ability of MBT plants to remove further valuable fractions from residual waste. In the absence of such large-scale investments, **separate collection** remains the primary means of ensuring proper management of spent batteries and small WEEE. Strengthening the coverage of collection points, simplifying disposal methods and raising citizens' awareness through information campaigns are therefore essential actions to reduce the presence of these waste streams in residual waste, improve collection rates and harvest the values of materials that, if correctly intercepted, can make a tangible contribution to the transition towards a more circular economy.

CONTACTS



 @Erion



02-50020350



www.erionenergy.it / www.erionweee.it



progetti@erion.it



Si ringrazia Ecologia Viterbo per la disponibilità, la collaborazione e il supporto fornito durante lo svolgimento dello studio.