

FROM INNOVATION TO IMPLEMENTATION

A CASE STUDY ON BATTERY X-RAY SORTING

BACKGROUND

Pioneering a Breakthrough in Battery Sorting

Several years ago, a battery collection company approached LINEV Systems with the goal of increasing their revenue through battery sorting and obtaining a purer fraction during the recycling process. A team of innovative specialists at LINEV Systems embarked on the development of a battery sorting system utilizing X-ray technology.

The process involved several years of work to create the system and develop algorithms for the automatic identification of battery types based on X-ray images. The result was the Battery BSSI60X solution, which has since become an unparalleled tool for addressing the challenges faced by LINEV Systems' customers worldwide.



INTRODUCTION

Empowering Eco-friendly Solutions in Waste Management

In addition to their expertise in the high-voltage power lines sector, Seval Srl diversified into the Ecologia division in 1999, focusing on the emerging market of Waste Electrical and Electronic Equipment (WEEE). Today, they lead the WEEE market with 8 facilities, handling over 130,000 tons of waste annually. Seval collaborates directly with major global electronics manufacturers, recovering materials like metals, plastics and precious materials through authorized and monitored processes.

Advancing Battery Sorting through X-ray Technology

For over 30 years, LINEV Systems has been a leading player in the X-ray equipment market, with business partners in 85 countries.

Among our longstanding partners is Seval Srl, an Italian company specializing in the recycling and sorting electronic waste, batteries, and metals. To enhance their battery sorting capabilities, Seval Srl adopted the BSSI60X X-ray sorting installation, developed by LINEV Systems, enabling them to sort between 350 kg and 500 kg of unsorted batteries per hour.

CHALLENGE

Overcoming Limitations with Smart X-ray Solutions

In an effort to automate the power element sorting line and increase processing capacities, Seval Srl tested various sorting technologies like ultrasound and optical ones. As these systems failed to meet the company's requirements, Seval and other partners started to develop a X-ray sorting system. It was at a conference dedicated to battery recycling technologies that Seval representatives discovered the potential of Linev X-ray technology for sorting power elements and battery recycling.

After studying the technical features of the BSSI60X X-ray sorting system and exploring the equipment's capabilities, Seval decided to quit its project and procure the system.





Unraveling Counterfeits and Enabling Cleaner Recycling

Additionally, the X-ray system BSS160X proved effective in detecting counterfeit batteries (fake labelling), which are impossible to identify by other means due to their striking similarity in markings and mass with genuine NiMH batteries or other chemistries.

Our system not only enables battery sorting but also provides a purer fraction for recycling (alkaline and ZnC batteries that are the most relevant fraction can reach 99.95% purity). Obtaining a clean fraction, free from contamination by other types of power elements, is crucial during the recycling process of specific battery types, as primary materials, black mass, may become contaminated, resulting in increased costs for purification.

Expanding Possibilities and Collaborative Innovations

After gaining substantial knowledge and experience with the BSS160X system, Seval approached us with an initiative to sort Li-Primary batteries into distinct groups, namely Li-MnO₂ (Lithium Manganese Dioxide), Li-SOCl₂ (Lithium Thionyl Chloride), and Li-FeS₂ (Lithium Iron Disulfide).

We enthusiastically supported this initiative and collaboratively embarked on implementing the project to introduce new battery sorting types. During the process, Seval provided samples of these battery groups, and we developed algorithms for their identification and sorting using the BSS160X battery sorting installation. This project will significantly accelerate the lithium battery (Li-Primary) sorting process compared to manual methods currently employed by all companies in the market.

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|--------------------------------------|-------------------------------------|
| 1 Damaged batteries detection | 4 Popular types of batteries |
| 2 Artificial Intelligence | 5 High purity of sorting |
| 3 High productivity | 6 Proprietary technology |

Revolutionizing Battery Sorting with Unmatched Efficiency

The BSS160X system became a key component in the sorting line, successfully sorting power elements into the following groups: **Li-Ion, Li-Primary, NiMH, NiCd, Alkaline and ZnC.**

With the ability to simultaneously sort approximately 1 ton of batteries per hour, the system achieved maximum productivity. The constant presence of operators is not required, allowing for optimal resource planning and load management of the sorting line.

ABOUT LINEV SYSTEMS

LINEV Systems provides advanced X-ray scanning technology designed to keep schools and educational campuses safe. The company's weapons detection solutions are trusted by school administrators, safety officers, and security professionals for their efficiency, accuracy, and ease of use. With products deployed in over 40 states, LINEV Systems helps create secure learning environments where students, staff, and visitors can feel safe. When it comes to school safety, LINEV delivers reliable protection students and staff can count on.

Driving Innovation through Customer Collaboration

Our collaboration with customers allows us to continually discover new applications for the BSS160X system. We are also open to developing new types of installations and tackling our customers' more complex challenges. We are eager to explore innovative ways to utilize sorting systems on recycling and sorting lines for batteries, opening up new possibilities for their application.



CUSTOMER SUCCESS AND COST REDUCTION

— This technology and LINEV that developed it is a step forward. Battery sorting is hard manual work, and we always had in mind to try to avoid that task. From the first days, we have achieved good results. We have already been able to decrease by 30% the selection cost for our customers.

Alessandro Danesi
Commercial Director of Seval

CONCLUSION

LINEV Systems and Seval Srl's partnership showcases how X-ray technology has revolutionized battery sorting, enabling eco-friendly waste management solutions, uncovering counterfeits, and reducing costs for recycling processes. The collaboration continues to drive innovation and expand possibilities for future applications.