

# The Future of Waste Sorting on Campus: AI Smart Bins

The next generation of thinkers, creators, and leaders are today's students. Purposeful engagement and support of AI-powered recycling systems will help students retain these critical, sustainable behaviors once they leave the university setting, and will ultimately drive a zero-waste future.

By Rachel Whitener

GENERATING MOMENTUM IN THE CIRCULAR ECONOMY means we must manage our waste smarter. As the world's population grows, so does its waste generation. In places where people spend a lot of their time, like university campuses, mitigating waste is critical to achieving sustainability goals.

Educational institutions are perfect candidates for introducing innovative solutions to tackle environmental challenges. The ongoing research, development of new technologies, and presence and authority in the community make colleges and universities the ideal place to disrupt traditional waste practices and demonstrate their commitment to intelligent solutions.

## Education Begins with Responsibility

Universities and other educational settings provide an excellent

growth opportunity for waste technologies as they represent environments where the population naturally generates a large amount of waste, including food waste. In its most recent waste audit, Toronto Metropolitan University (TMU) found that more than 60 percent of all waste sent to landfill could be composted or recycled. The University of Richmond, which has set an ambitious goal of 75 percent waste diversion by 2025, found in a 2021 audit that as much as one-third of the campus waste sent to landfill was compostable.

Millennials and Gen Z, groups that make up the majority of college students, have reported a deeper sense of responsibility for fighting climate change. Their commitment to prioritizing sustainability makes them the ideal audience to support and help implement new strategies.



TrashBot, USA



EvoBin, USA



Oscar Sort, Canada



Bin-e, Poland

AI waste-sorting bins revolutionize campus waste management and drive sustainability impact.

Images courtesy of CleanRobotics.

## Making a Complex Process More Efficient with AI

Enhanced waste management depends on finding and separating reusable material from vast quantities of refuse. Traditional bin systems place the burden on the user to sort their waste into the correct bin; however, even with adequate signage, humans get this right only 30 percent of the time. Confusing recycling rules and a lack of education result in high contamination rates and poor diversion.

Applications of AI in waste management help simplify a formerly complicated, expensive, and painstaking process. One of the key solutions AI offers is eliminating the user's decision-making process at the source, which has positive ramifications down the line. AI technologies can impact the entire waste lifecycle—from sorting at the source to real-time monitoring and analysis to predictive modeling to increasing public engagement.

For campuses, AI can drastically impact the cost efficiency of waste collection. In addition to increased sorting accuracy, smart bins can deliver fullness alerts, so custodians only need to check the bins when they get a notification. This helps improve custodial efficiency and reduce unnecessary labor. The data collected by smart bins can also deliver expense projections and illuminate areas for improvement.

Waste data is highly effective at reflecting waste trends specific to a campus and its population. These insights are key for universities that want to support their student population while reducing waste generation. Waste audits can reveal an overabundance of certain materials in the landfill bin, which can inform purchasing decisions or help enhance education. They can also illuminate knowledge gaps, such as if the bin notices clean recyclable bottles are thrown away with liquids still in them.

Many universities still conduct manual waste audits, by transporting all the campus waste to one location and having volunteers sift through it by hand. Smart bins can streamline this process by automatically recording data as waste is collected. High-quality analytics and on-demand audits can be accessed through a simple online dashboard. These analytics are critical to decision-making and improving policies.

Tech solutions that combine autonomous waste management and an enhanced user experience will have the most significant long-term impact. Smart bin systems using AI and robotics to sort waste at the time of disposal manage the process for the user. These systems can be calibrated to comply with local recycling rules and regulations, which means minimal or no contamination and the avoidance of fines.

AI bins also provide value through responsive recycling education. Despite their best intentions, humans often become the biggest barriers to recycling. Due to a gap in recycling education, people will throw away containers with grease or other food contaminants into recycling bins. Wishcycling is also a phenomenon that causes significant issues for recycling systems. People put something in the



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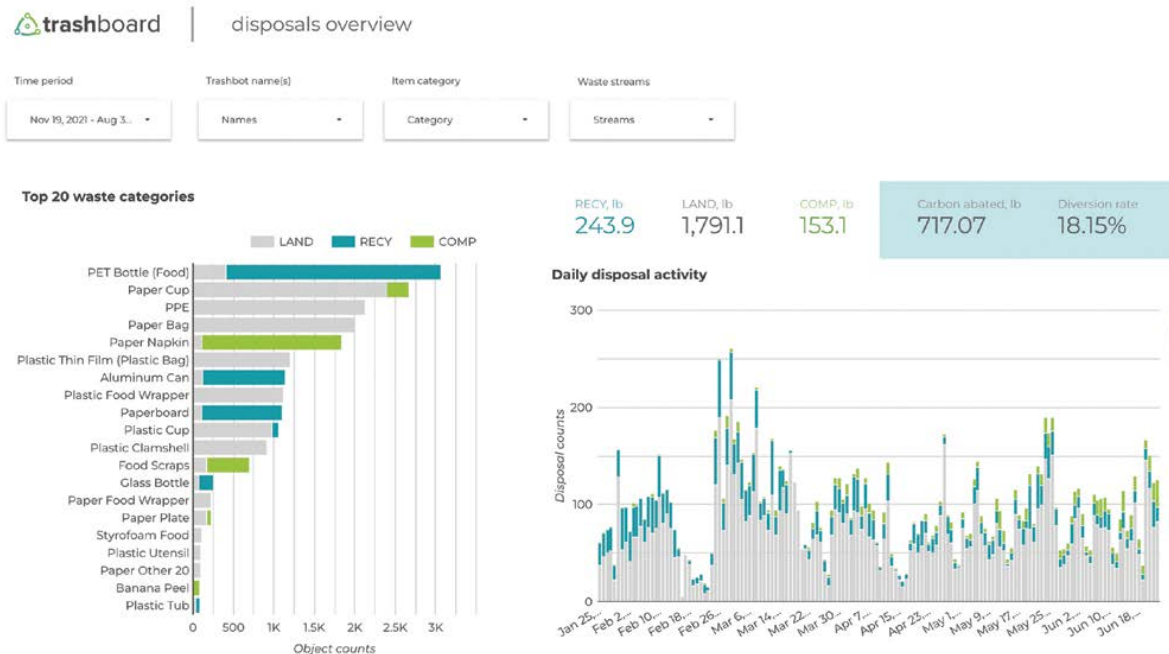
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TrashBot's dashboard provides detailed data on the waste collected and tracks carbon abatement.

recycling bin that they hope will be recycled, but the reality is that they contaminate the rest of the waste in the bin, and everything goes to landfill.

Oscar Sort and EvoBin, made in Canada and the U.S., provide gamification and respond to the user as they deposit their waste. TrashBot, also made in the U.S., uses AI and computer vision to recognize the waste deposited and through a built-in screen, delivers context-specific education based on the waste disposed. The benefit of all these systems is that users can participate in the process and get tips on how to improve their recycling behavior. Recycling education is a critical link that connects people and their impact.

Machine learning provides an additional benefit to waste management, as it allows the system to get smarter over time. The more unique waste items a smart bin "sees," the more waste it can identify and sort. As these bins recognize more unique waste items, their data tracking ability improves.

## Benefits for Facilities

Educational institutions need partners in sustainability. Using smart bin solutions for waste disposal can mean substantial benefits for a campus, including:

- Increased student engagement around waste reduction and recycling
- Customizable compliance, meaning more cost-effective recycling
- Digitization of waste management

- Real-time data and analytics
- Educational content and custom messaging for users
- Higher diversion rates and lower disposal fees
- Credits toward green certifications

Committing to sustainability is a lifelong endeavor, so college environments are critical to introducing and nurturing this knowledge. The next generation of thinkers, creators, and leaders are today's students. Purposeful engagement and support of AI-powered recycling systems will help students retain these critical, sustainable behaviors once they leave the university setting, and will ultimately drive a zero-waste future. | **WA**

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