Paper Spotlight

AI and recycling—creating sustainable synergies

By Huban Kasimi

Artificial intelligence has become an enabler of seamless sorting processes across multiple industries. However, is it a game-changer for recycling technologies? Felix Hottenstein, sales director of MSS, the optical sorting division of CP Group, explains the necessity of smarter technology, especially for recovered paper.

Recyclers, material recovery facilities (MRFs), and mills are increasingly investing in sophisticated processing and sorting technology. As the need to upgrade, modify, or completely revamp continues to strengthen, equipment manufacturers are also raising the bar in providing top-notch equipment and services. The rate at which these technologies are coming online has accelerated over the last decade. More and more smaller paper mills have closed or are being integrated into bigger sites. We are also seeing MRFs expanding either in-house or to other locations.

The capital required to bring about these advancements is extensive. Even though an upgrade may be vital, it is also important to consider the different types of technologies that will work for a particular site. Artificial intelligence has opened doors to many more options, and the right fit can turn an underutilized or defunct facility into a productive one. Let us take a look at what AI has to offer to the recycling industry.

A potential game-changer for sorting

Automated sensor technologies have changed how materials are processed and sorted in MRFs over the last few decades. Near-infrared (NIR) technology was introduced to the recycling sector over 35 years ago. The latest generation of optical sorters came online less than 5-10 years ago and has made it easier for material recycling facilities (MRFs) to reduce contamination. These technologies classify and sort different paper and cardboard grades, and on the plastics side, they can sort plastics like PET, HDPE, PP, and other materials separately.

NIR, color, and metal sensors are commonly used in mass-sorting MRF applications. Depending on the application, just one or possibly a combination of these individual sensors could be required to achieve the sorting goal.

“Certain sorting applications lend themselves better to conventional optical sorting machines; for others, AI can provide additional advantages or be the only applicable solution. At MSS, we can build either entire plants from scratch or retrofit certain new pieces of equipment based on these requirements, using either just one or a combination of sensor technologies,” according to Hottenstein.

AI’s deep-learning capability complements NIR, and its levels of available granularity provide finer classifications of individual product and material categories. Furthermore, AI sensors can provide identification capabilities that NIR does not have.

AI can be a game changer for MRFs and recycling plants in terms of monitoring and quality control of generated commodities. Making operational decisions is now easier since material composition and statistics are automatically compiled and analyzed in real-time.

Improved processing volumes and quality

Equipment manufacturers are making bigger and more advanced sorting machines as well as complete systems by the year. A higher degree of automation has raised processing throughput while at the same time producing less contaminated commodities. In other

words, facilities can now bale more net tons per hour at higher quality levels.

MRFs and recycling plants can choose to modify existing equipment, expand the current site, or build a new and larger facility. According to Hottenstein, an important technical factor when deciding on a major plant retrofit vs. a brand-new sorting system is access to more space and power. Contractual agreements between the municipalities/cities and the MRF operators also play a vital role in determining whether a site can and should be upgraded again from a financial standpoint. This especially holds for facilities that cater to residential curbside collection.

Hottenstein reiterates that a retrofit is probably suitable after 5-10 years. Beyond that, especially after 15 years, even the core parts can become more expensive to maintain. Moreover, by that time, newer and more advanced processing and sorting technologies will be available that can reduce operational costs and eliminate abrasive sorting processes even further.

Besides capital investment, operational costs such as energy consumption, spare parts usage, and labor need to be carefully considered during such an evaluation period. Skilled labor is still a challenge to find and becoming more expensive. As far as MRFs are concerned, automation will shift the type of labor that will always still be required from manual sorting more towards technical maintenance and machinery upkeep.

Robotics vs. air jet extraction solutions

AI and other recently advanced technologies have made the identification and classification of different material categories much more precise and robust. However, according to Hottenstein, the consensus regarding the means to extract the targeted materials is divided between the use of vacuum-based robotic arms and positive-pressure air ejectors.

“MSS firmly believes that sensor technology needs to be decoupled from the means of extraction. An appropriate detection technology, be it a single sensor or a combination of them, must be paired with the right extraction method for the best results”, Hottenstein adds.

Robotics can be a good solution for a retrofit where space is limited. However, many facilities still prefer an air ejector solution. The latter’s pick rate is ten times faster and more effective. Robotic arms are vacuum-based, and the per-minute movements are limited. For example, if there are three items coming out of a sorter, a robot will only be able to concentrate on one or two of them. In such instances, air jets have an advantage.

Consistency is key for better sorting

No matter what combination of sensor technology and extraction method is used, any automated sorting system will generate higher volumes at higher commodity qualities vs. more manual sorting systems. Processing is also more consistent,” noted Hottenstein.

The composition of the commingled inputs, especially at MRFs, has become more varied and complex. For example, plastic-coated paper or hazardous or non-certified materials tend to make sorting tasks challenging. A recent and bigger push towards flexible packaging has also made mechanical as well as optical sorting more challenging. Many cartons or produce boxes have multiple layers of film and plastics, which may or may not be recyclable.

Even in recovered paper, there is now a sort of imbalance. At one point, MRFs received plenty of newspapers and printed paper, but now different types of recovered paper grades come in. The older a facility, the more difficult it is to accept these newer and more diverse types of paper and packaging materials while still maintaining the same system throughput and product qualities. “There is always something newer or better in terms of packaging, and the challenge is to design equipment that can adapt to these ever-changing input streams. Newer facilities tend to be more flexible and can be rebalanced easier when it comes to accepting multiple inputs that can change over time.” according to Hottenstein.

Commodity price fluctuations should be considered

Just as the ever-evolving ton affects the performance of an overall MRF sort system, commodity price fluctuations are also a big challenge for recyclers. Equipment manufacturers like CP and MSS aren’t immune to commodity values. “Making a financial case for a new recycling or retrofitted facility is tricky when commodity prices are inconsistent. One has to adapt and be flexible. It’s not only about the technology itself. Our customers need to be able to withstand volatile markets as well.”

Hottenstein states that an ideal situation would be if there were more stability. “The last 3-4 years have been great for machine manufacturers like us. But there have been stages of lower investments. It would be nice to see some balancing out in commodity prices.”

There is always scope for innovation

The rise of AI in sorting machines has opened doors to several innovative ideas and processes. Hottenstein states that with better technology, customer requests for newer and more sophisticated sorting tasks have become more prevalent. Equipment manufacturers are also receiving requests for more integrated sensor sorters and other cutting-edge tools.

Newer automated sorting technologies are better and more consistent than older, manual processes. When MRFs can save more tons from being landfilled, this is a good indicator of optimal value generation and contribution to a more sustainable future.

Hottenstein concludes that developing the latest generation patented near-infrared spectrometer was a milestone achievement for MSS. Since adopting the new AI technologies, the company has also been able to better define the applicability parameters of AI-integrated processes.

Felix Hottenstein has been with MSS, the optical sorting division of CP Group, for nearly 25 years. CP is a manufacturer of turnkey materials handling and sorting systems for the recycling and waste management industry.