The past two decades have seen a remarkable transition in America’s recycling processing landscape. Single-stream materials recovery facilities (MRFs) have grown rapidly in all areas of the country as firms and governments harness technology improvements and employ single-stream collection, a method that has proven to boost efficiencies and bring in more material.

However, we have not reached the end of technological development with respect to recycling. Localities nationwide are now implementing two-bin systems (organic and non-organic waste) as well as one-bin systems (all waste, including recyclables, in one rollecart). In the process, they are forcing a pivotal question: What will recycling systems look like in the future?

This article aims to offer some insights on that point. It is part of ongoing MRF analysis from Governmental Advisory Associates, Inc. and is based on the firm’s extensive surveying of recycling processing operations in the U.S. (the last time this author offered an update in these pages was July 2013). This latest take on the state of American MRFs details the dramatic rise of single-stream sites and delves into the renewed interest in mixed waste processing facilities. With debate raging over the merits of different processing approaches, it’s useful to understand the level of implementation that is already under way.

Growing single-stream facilities
Over the past 25 years, the number of MRFs in the U.S. has increased 15 times as curbside collection of recyclables spread across the country (see Figure 1 on page 21). In the early years of curbside recycling, MRFs were concentrated in the Northeast, but today they are evenly distributed throughout each region (see Figure 2 on the page 21). The early curbside collection programs relied on residents to carefully sort their materials into multiple containers, and in most communities these multiple containers gave way to two bins for recyclables (one for fiber and one for containers). Within the last 10 years, another transition took place as municipalities moved to a single bin for all recyclables.

As the number of facilities has increased, so has the average throughput of facilities. Average daily throughput is currently about 165 tons per day, an increase of 28 percent over the last 12 years (See Figure 3 on page 22). Nearly half of the plants (45 percent) are handling throughputs above 120 tons per day, and plants continue to increase in size. The average throughput of a new plant built or retrofitted since 2007 is 216 tons per day.

In part, the growing size of MRFs can be attributed to the move to single-stream recycling. This type of recycling became possible with the development of advanced sorting technologies, which allow operators to disaggregate the combined material stream coming in from more and more communities. Furthermore, communities were able to increase the materials to be recycled, adding multiple fiber and plastic grades to their recycling programs. According to our research, there are now nearly 300 operating single-stream MRFs (see Figure 4 on page 22), accounting for 47 percent of the total number of MRFs in the U.S. This proportion is...
continuing to increase as older and smaller plants close. Of facilities built after 2007, 77 percent are single-stream MRFs. These new single-stream plants average 225 tons per day, and most of them have installed multiple mechanical and optical technologies to achieve a high level of sorting efficiency.

Every corner of the country
Over the years, single-stream MRFs have become equally distributed across all regions of the country. As Figure 5 on page 22 illustrates, the West saw the initial adoption of single-stream curbside collection. However, over the last decade, the practice spread eastward, and currently these types of plants are found in nearly equal numbers in the West and South. The Northeast has been the slowest to move toward single-stream, in part because this area was the first region to develop MRFs and already has an existing, albeit aging, processing infrastructure.

The drive toward single-stream recycling has both pushed and been pushed by the evolution of sorting technology. Optical sorters represent some of the most advanced pieces or sorting equipment in a MRF and are used to separate plastic grades, fiber grades or glass by color. These systems use near infrared detection, through which material moves on a belt under a powerful light source. Lenses capture the reflection of light off the material, and the machine allows selected material to be blown off the belt by air jets.

With the advent of single-stream recycling collection, an increasing number of facilities are turning to this technology to improve sorting efficiencies. Out of the 163 plants nationwide with optical sorting, 76 percent are single-stream facilities, and surveying showed most of the MRFs are using optical sorters to separate plastics, particularly PET and HDPE. Figure 6 on page 23 shows the extent to which this technology is being adopted.

Mixing it up
Seeking lower collection costs, larger quantities of materials and greater citizen convenience, communities across the country have converted or are converting to single-stream collection. However, some communities and private firms have pushed beyond that option, evaluating whether sorting technologies can be applied to a fully mixed waste stream (recyclables and refuse together). In this way, some communities are coming full circle, moving back to just a single bin at the curb.

It should be noted that mixed waste processing facilities (MWPF) are not a new idea. Figure 7 on page 23 shows a breakdown of these mixed-waste facilities by year, both with respect to operating and planned projects. MWPFs have been part of the recycling infrastructure for at least 20 years. Their numbers grew through the early 2000s, with at least 49 additional plants in planning in the mid-1990s. Mixed waste plants were perceived to have multiple advantages. They filled a recycling void in areas where no recycling infrastructure existed. Furthermore, in an era of high energy prices, some of these plants were conceived as producers of a pelletized refuse-derived fuel. Recyclables would be separated from the waste stream, and remaining residue would be shredded, pelletized and sold as
fuel to be burned in industrial or utility boilers. By the late 1990s, the development of mixed waste facilities slowed. Planned facilities were canceled, and many existing plants shut down or were converted to traditional MRFs, handling only recyclables. This drop-off coincided with widespread adoption of curbside collection of recyclables and the growth of MRFs in general. The phenomenon was also related to concerns over the health and welfare of plant workers at mixed waste facilities, cost concerns, and equipment technology and maintenance issues. Furthermore, the market for refuse-derived fuel never fully developed, due to lack of homogeneity of the fuel product and overall lack of demand.

However, in the last few years, mixed waste processing has made a comeback. Some plants have continued to operate in rural and sparsely populated areas, where curbside programs are challenging to implement. A few existing waste-to-energy facilities have added a mixed waste processing component on the front end to sort out valuable metals and other materials as well as items that negatively affect the combustion process.

In addition, the major improvements in sorting technology found in MRFs are being applied to mixed waste plants. Equipment manufacturers have developed highly automated sorting systems that reduce worker exposure to dust, odors and dangerous materials while achieving effective levels of material separation. Finally, there is now intense focus on capturing the food waste/organic stream, and this task can be handled at MWPFs. The organic stream can be converted into biogas or compost, substantially boosting recycling or landfill diversion rates. Many of the new mixed waste facilities run multiple lines, processing a separate recyclables stream and a mixed waste stream.

The Western front
Most of the mixed waste facilities currently exist in the Western U.S. (more specifically, in California), as shown in Figure 8 on page 24. In fact, 71 percent of the operating MWPFs are located in the Golden State, while six of the 11 planned projects are located in that state. The reason for California’s dominance with respect to MWPFs has been its long-standing focus on landfill diversion as well as the enactment of laws such as AB 341, a piece of legislation from 2011 that mandates recycling at businesses and many multi-family dwellings. This initia-
tive is part of Gov. Jerry Brown’s ambitious goal of 75 percent recycling, composting or source reduction of solid waste by 2020. As a result, some localities and private firms are looking to MWPFs to deal with the unseparated commercial/multi-family waste stream.

Often these facilities are being planned with an anaerobic digestion/energy recovery component. A recent example is San Jose, California, which in 2012 implemented a two-bin collection system for its commercial and multi-family units. Wet waste (food, organics and soiled paper) goes in one bin and dry waste (everything else) in the other. Republic Services won the newly created franchise to collect and manage this waste. To execute the franchise agreement, Republic invested $45 million to retrofit its Newby Island MRF, adding new sort lines for the organic “wet” fraction and inorganic “dry” fractions of the stream. Both bins come to the sort facility, and errant recyclables or inorganic materials are initially pulled from the “wet” waste. The organics then pass through trommels and various screens before being shipped to a nearby anaerobic digester, where biogas and compost are produced.

The renewed interest in these types of facilities is not limited to California, however. Officials in other regions of the country, particularly the South, are also evaluating and implementing mixed waste recycling. These tend to be one-bin systems, in which residents and businesses place all materials, recyclables and garbage, in a single container. Low recycling participation rates and high collection costs are pushing some of these localities to examine the feasibility of a MWPF. The city of Montgomery, Alabama, for example, made the decision to halt its curbside recycling collection program and send its unseparated trash to a highly automated Infinitus Energy mixed waste plant, which began operation in fall 2014. The plant is taking about 100,000 tons annually of MSW from Montgomery as well as single-stream recyclables from municipalities in Florida. According to Infinitus, the second phase of the project will involve the construction of an anaerobic digester at the plant to process the organic fraction of the waste.

A nationwide trend?
The cities of Houston and Indianapolis are also evaluating proposals to implement mixed waste processing, being drawn to the method after experiencing low participation rates in curbside recycling programs. Both initiatives have generated considerable controversy — opponents view them as undermining all the investment that has gone into creating effective and sustainable curbside and source-reduction programs. Several mixed waste plants in Michigan and Virginia have also begun operations in the last few years, and their effectiveness is still being evaluated.

Thus, it remains to be seen if the approach being implemented by some California localities is unique, driven by the state’s intense focus on landfill diversion, or if it is truly a harbinger of a new nationwide trend. Are MWPFs a solution to chronically low recycling rates in certain regions of the country? Are two-bin (wet/dry) systems and the facilities that will process these streams an inevitable consequence of continuing advancements in sorting technology? Are we seeing a future in which the single-stream MRF will be replaced by a MWPF arrangement?

The answers to those questions will emerge in the coming years, and further surveying of MRF operators will give the industry some hard data on how the pro-
cessing sector evolves. What’s clear is that technology and pressure for greater diversion will continue to shape the MRFs of America.

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