The multi-layer flexible pouch is at the center of a major debate between sustainability and recyclability. The reason? Even though those pouches use significantly less material than other forms of packaging, as well as carry lower greenhouse gas emissions and extend the shelf life of food, reducing food waste, they’re not readily recyclable today.

If pouches had a niche focus, they might not cause such an issue because “the environmental benefits upstream are far greater than the packages they replace,” says Amy Roth, principal with Green Spectrum Consulting.

But this is no niche phenomenon. About 80 billion single-material and multi-layer pouches are used annually in the U.S. And about half of them are multi-layer pouches composed of laminated multiple materials, according to the Flexible Packaging Association.

The packaging method is seeing greater use for food, beverages and household products such as detergents. By 2018, the number of pouches used annually in the U.S. is expected to reach 92 billion units with a value of $9.4 billion, according to a recent research report from the Freedonia Group, Inc., with stand-up pouches – most of them made from multi-material laminates and films – growing at 6.5 percent annually compared with 4 percent for flat pouches.

What’s more, pouches for non-food applications – such as consumer goods – will grow even more rapidly than the food and beverage segment, which accounted for 80 percent of pouch use in 2013.

“By 2017, the amount of flexible packaging will grow to more than 9 billion pounds,” says Roth, with the majority of it going to landfills.

Will all that material ever be able to be recovered? Some technologies are developing that could turn the material into fuel or oil, or possibly even create recycling avenues. But for the moment, nothing seems a sure bet, and the flood of flexible film continues unabated.

“Not feasible to recycle”

To be sure, the scrap material from manufacturing multi-layer flexible pouches can and is being recycled on a post-industrial level by a number of firms (see sidebar).

But even the Flexible Packaging Association (FPA) admits that post-consumer multi-layer pouches can’t be recovered within existing systems. “It is currently not feasible to recycle multi-material packaging because the current recycling processes are designed for heavier, thicker and single-material packaging,” stated a 2014 FPA research report on the resource recovery options for flexible packaging.
Post-industrial? Not a problem

While multi-layer, multi-material pouches are causing a stir in post-consumer recycling streams, processing the scrap from pouch manufacturing has proven to be a welcome opportunity for some post-industrial recycling firms.

“We went into flexible film in a big way in 2007,” says Neil Gloger, chief executive officer of InterGroup International Ltd., which has plants in Atlanta, Missouri and Euclid, Ohio, where it is headquartered. “We looked at what niches were open and saw flexible packaging as an open opportunity. We saw a market with a high scrap rate where there was no consolidation on the buying side. The key for us was a scrap rate at converters that was extremely high – 12 to 14 percent – and contracts for most pouches that typically have a 10 percent overrun.”

The value of the material can vary based on a number of factors. The single largest resin InterGroup recovers, polypropylene, is separated and sent overseas where it is turned into twine.

Gloger says the recycled resins he sells are turned into everything from pallets to trash cans, roofing materials, interior car parts, lawn and flower edging, shutters, trash can liners, and outdoor furniture and toys.

The aluminum he recovers from pouches is re-used in low-end applications or pulverized for the munitions industry.

And in just seven years, InterGroup has grown its volume to 100 million pounds, almost all of it from flexible packaging materials, and works with most of the major converters that make the flexible films for pouches.

Similarly, PARC Corp. recycles plastic trim waste and food packaging polymer laminates such as PET/PP and PET/PE laminated films from companies like Berry Plastics and Curwood/Bemis. PARC also recycles multi-layer film pouches/bags.

The material is hand-sorted into plastic pouch bag types, baled at its plant in Romeoville, Ill., and sent to its China facility where it is ground, pelletized and used to make products such as deck boards for sea containers, end caps for the steel industry and plastic skids for appliances.

Flexible packaging material staged for recycling inside InterGroup’s Euclid, Ohio facility.

And while it is possible to turn both single-material and multiple-material pouches into fuel through pyrolysis, that technology is still developing. That possible solution is also complicated by the fact it would demand a separate curbside collection system for pouches as well as materials recovery facility (MRF) redesigns.

It’s a conundrum that has manufacturers and brands looking for a solution even as they point out the many sustainability advantages multi-layer pouches have over the packages they replace.

On the other side of the debate, some industry observers are adamant that packaging that can’t be recycled should be redesigned or simply not used.

“There are some clear benefits to pouches. They are lighter-weight, they reduce carbon emissions and they cost less to transport,” says Matt Prindiville, associate director of Upstream, a group that works to persuade companies to develop sustainable packaging from materials that can be continuously reused or recycled. “The problem is that [multi-layer laminate] pouches are not recyclable, so right off the bat they violate the principles of the Sustainable Packaging Coalition.”

Monica Wilson, U.S. and Canada director for the Global Alliance for Incinerator Alternatives, also understands that there are other environmental and social factors to take into consideration when designing packaging. “But that doesn’t excuse companies from designing something that can’t be recycled,” she says. “The discussion can’t be lightweighting versus recycling; it has to be both. To design a product that isn’t recyclable is outrageous, especially when you are replacing packaging where there already is a roadmap for recycling.”

Thinking beyond recycling

Others argue that dismissing a type of packaging because it can’t be recycled is a shortsighted way to look at sustainability.

“People are against pouches because they are not very recyclable,” says Neil Gloger, chief executive officer of Inter-Group International Ltd., which works with converters, consumer brand companies and printing firms to recycle the industrial scrap from pouch manufacturing. “But pouches still win on the overall carbon footprint number.”

Indeed, a sustainability study conducted by Battelle Memorial Institute for FPA found that the energy consumption figures, carbon dioxide emissions and the material requirements used to make a stand-up flexible pouch for non-carbonated beverage packaging was significantly less than those of an aluminum can, a PET bottle and cap,
or a glass bottle and metal cap (see chart below).

“It almost seems to me that some people in the environmental space keep changing the rules,” says Gloger. “When everyone should be cheering because of the pouch’s overall lower carbon footprint, they are instead complaining that it doesn’t have a good end-of-life.”

Peter Hunderup, managing director of the PIRA Group and resource recovery consultant for FPA, has a similar view. “You have to look at the product/package combo during its entire life cycle and ask what gives you the best results overall,” he says. “End-of-life issues are just one component.”

Both the plastics industry and the flexible packaging industry have begun looking at pyrolysis as an end-of-packaging-life alternative to recycling pouches. “Resource recovery is a good end-of-life option for multi-material laminates,” says Marla Donahue, FPA president, and “pyrolysis [is] the most promising technology at this time to recover the embedded energy” in flexible packaging.

“Pyrolysis is not incineration,” adds Hunderup. “It is chemical transformation with no combustion in an oxygen-free environment. You are taking polymer chains and breaking them back down into smaller components and then combining them back into oil. It is a really clean process with almost zero emissions.”

To be sure, pyrolysis is still in the early stages of commercialization – mostly at the pilot stage – with a few exceptions. But if the process can be developed and pouches and other hard-to-recycle materials can make their way into the system, the environmental argument could be bolstered by an economic one.

An American Chemistry Council report last fall said turning non-recycled plastic into oil could generate up to $9 billion in economic output annually in the U.S.

Michael Dungan is director of sales and marketing at RES Polyflow, which has a plastics-to-oil plant in North Perry, Ohio that is currently offline for equipment upgrades. He sees flexible packaging as a powerful opportunity.

“Diverting these types of materials to a plastic-to-oil conversion technology where the energy embodied in the product can be harvested and repurposed efficiently with very little sortation or extra measures is a smart way to extend the life of local landfills while adding jobs to the economy,” he says.

**Why recycling option isn’t “anywhere near reality”**

In addition to pyrolysis, the flexible packaging industry is starting to look into potential long-term solutions on the design and recycling side.

A case in point: The recently announced Reflex project in the U.K. hopes to find ways to remove the barriers that prevent flexible packaging from being recycled.

“Recycling these materials is still very technically and commercially challenging,” says Roger Morton, director of resource recovery consulting firm Axion Consulting, one of the eight companies involved in the project. “The complexities of these multi-layer barrier films make them virtually impossible to recycle by current methods because of the mix of polymer types and inks used.”

Roth of Green Spectrum concurs. “The different materials meld together when the pouch is made, there is a change in the molecular structure, and it is nearly impossible

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### Beverage Packaging

<table>
<thead>
<tr>
<th>Beverage Packaging</th>
<th>Product Weight</th>
<th>Packaging Weight</th>
<th>Product-to-Packaging Ratio</th>
<th>Packaging Weight per 100 g Product</th>
<th>Energy Consumption MJ/8 oz</th>
<th>Emissions Kg CO₂ e/8 oz</th>
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<tr>
<td>Glass Bottle &amp; Metal Cap</td>
<td>8 ounces (236 g)</td>
<td>198.4 g</td>
<td>1:1</td>
<td>83.9 g</td>
<td>3.36</td>
<td>0.29</td>
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<tr>
<td>Plastic PET Bottle &amp; Cap</td>
<td>8 ounces (236 g)</td>
<td>22.7 g</td>
<td>10:1</td>
<td>9.6 g</td>
<td>3.00</td>
<td>0.18</td>
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<tr>
<td>Aluminum Can</td>
<td>8 ounces (236 g)</td>
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<td>4.7 g</td>
<td>0.99</td>
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<td>Stand-up Flexible Pouch</td>
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<td>5.7 g</td>
<td>35:1</td>
<td>2.8 g</td>
<td>0.45</td>
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Source: FPA/Battelle Memorial Institute, Sustainability Assessment of Flexible Packaging; and Flexible Packaging! Less Resources, Energy, Emissions, and Waste (brochure) Cradle-to-grave life cycle energy consumption and greenhouse gas emissions data developed for FPA by Battelle Memorial Institute. Packaging weight, product weight, and product-to-packaging ratio calculated by PTIS. Beverage assumed to be water.
to pull the materials apart and separate them into single resins,” she says.

That’s why Martin believes that what’s necessary are “innovative recyclable flexible package designs … where all the materials used can be reprocessed together.”

But still a solution might be years away. “A recycling solution isn’t anywhere near reality at this point,” says Hunderup. “The technology might be developed over the next 10 years. But even if it is, that doesn’t make it economically feasible.”

There are also the issues of how to collect pouches from consumers, and how to handle them at MRFs.

For collection to work, “you’ve got to make it easy for people,” says Prindiville. “There would be nothing wrong with a store take-back program, but that won’t collect a lot of material. The real solution is something more convenient tied into the way people are already recycling.”

In the “Energy Bag”

To gain insight into the collection issue, material manufacturer Dow Chemical, resource recovery firm Republic Services, plastics-to-oil company Agilyx and FPA conducted a three-month pilot program in Citrus Heights, Calif., this past summer that tested the use of a purple Energy Bag to collect pouches and other non-recyclable plastics such as candy wrappers, frozen food bags and pet food bags.

According to a draft report on the program, the purple bags enabled collection to be integrated into an existing recycling program, with contamination rates no different than those of more established materials.

In addition, the distinctly colored bags, stated the report, “helped tremendously and made them easy [for Republic] to identify and pull at pre-sort” at the front-end of its operation. PET levels were higher than ideal, but, even with that, the oil conversion efficiency through pyrolysis tested at 58 percent, a figure the report said was “promising” for future pilots.

The second, and maybe larger, challenge is finding a way for MRFs to adjust their operations to potentially handle multi-layer pouches – and do it in an economically feasible way that is profitable.

“Pouches can be a big problem for MRFs because you don’t know what they’re made from – a single material or multi-layers,” says John Standish, technical director at the Association of Postconsumer Plastic Recyclers. “And unless they are sorted before they get to a MRF, you’ve got to have people who can visibly see them and pull them out.”

In addition, because pouches are two-dimensional and flat, they can end up contaminating the paper stream. “You need access for people to recycle them, you need economic feasibility for MRFs, and you need technical feasibility,” says Standish, “and pouches are suffering on all three scores today.”

Besides, the switch from traditional recyclable packages to flexible packaging “completely confounds the business models” of public and private MRF operators that built their facilities based on collecting and selling certain amounts of paper, aluminum, and PET and HDPE plastics, adds Prindiville.

The low value of flexible material simply doesn’t justify investments by MRFs, says Susan Hubbard, founder of Nothing Left to Waste, a zero waste social enterprise organization.

“Investments to sort out pouches aren’t feasible because you would need an enormous amount of money to separate it, clean it and make it marketable,” she says. “And you would need a completely different system than the ones MRFs use today. And even if it were feasible, there is no market for pouch material.”

Redesign the package … or the MRF?

Ultimately, the solution may require a redesign of multi-layer flexible film pouches to make them recyclable.

“Flexible packaging represents a huge challenge to current recycling routes because seemingly simple packages may incorporate several functional layers to deliver heat-sealed, oxygen barrier, metalized, printed and varnished packing with high-tear strength, good puncture resistance and minimum cost,” says Axion’s Morton.

Because of that, the industry may need to look at “innovative inks, new barrier polymers, novel packaging designs and automated sorting techniques,” he says.

Can that happen?

Sustainability expert Marty Grohman, a board member of Upstream and a member of the Maine House of Representatives, thinks so.

“We are recycling many things today that 10-to-12 years ago we didn’t think was possible,” he says. “I think manufacturers, brand owners and consumer product goods companies are going to keep feeling pressure to come up with something that’s recyclable. I would hope they’re actively looking for something.”

Gloger of InterGroup agrees.

“Let’s face it. No one wants to go back to glass containers, wax-coated paper or folding cartons that are going to drip,” he says. “And disposable packaging isn’t going to go away. So pouches are going to become even more ubiquitous than they already are.”

Gloger thinks turning those pouches and other non-recyclable plastics into fuel can be a solution. But he also says that in the long term, MRFs may have to redesign the front end of their processes. “It’s not going to happen overnight or in five years,” says Gloger. “And you will need a public-private partnership to make it happen because it’s costly, risky and counterproductive” to the current approach used by MRFs.

“But ultimately, it will be needed because the packaging mix in the marketplace is changing,” he says.

Mike Verespej is president of MAV Business Communications. He can be reached at maverespej@gmail.com or 440-973-4159.

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