# Flexible Packaging Resource Recovery: A Work-in-Progress

A Summary of the Flexible Packaging Association Report:
*Continuing Evaluation of Resource Recovery Infrastructures and Processes*

Flexible Packaging Association


# Flexible Packaging Strengths and Benefits

Flexible packaging offers many advantages. With a focus on technology, innovation and sustainability, flexible packaging:

- Provides excellent product protection
- Extends shelf life and reduces product waste
- Offers great shelf appeal and differentiation
- Improves consumer convenience and experience, including:
  - easy storage
  - reclosability
  - microwaveability
  - portion control
- Provides significant sustainability benefits to consumer product manufacturers, retailers and consumers (Table 1) through:
  - packaging efficiencies
  - increased product-to-package ratio
  - less energy used
  - fewer greenhouse gas emissions generated
  - less waste in the first place®

source reduction less waste in the *first* place.®

® "Less waste in the first place" is a registered trademark of The Flexible Packaging Association

# Not All Flexible Packaging Is the Same

Different products require different packaging attributes. Some are simple, some are complex, and each has a purpose. The more complex the packaging requirement, the more complex the packaging structure – some requiring multiple layers of highly engineered materials to provide the optimal protection for the product, extending shelf life and reducing product waste.

From a resource recovery perspective, flexible packaging can be divided into four major categories:

- **Polyethylene (PE) retail bags and films**, which are a single-layer material and can be recycled, primarily through store drop-off programs.
- **Predominantly polyethylene laminates**, which are a recent development and may be managed the same way as PE retail bags.
- **Multi-material laminates and films**, which provide barrier protection for the product and are more difficult to mechanically recycle than single material structures. They are, however, excellent candidates for resource recovery.
- **Non-polyethylene single-material films and bags** that may be managed the same way as multi-material laminates.

*PE retail shopping bag*


*Single-material laminate packaging*


*Multi-material laminated packaging*

**Table 1: Case Story Example of Many Sustainability Benefits of Non-carbonated Beverage Packaging**

| Beverage Packaging | Product Weight | Packaging Weight | Product-to-Packaging Ratio | Packaging Weight per 100 g Product | Energy Consumption MJ/8 oz | Emissions Kg $CO_2$ e /8 oz |
|---|---|---|---|---|---|---|
| Glass Bottle & Metal Cap | 8 ounces (236 g) | 198.4 g | 1:1 | 83.9 g | 3.36 | 0.29 |
| Plastic PET Bottle & Cap | 8 ounces (236 g) | 22.7 g | 10:1 | 9.6 g | 3.00 | 0.18 |
| Aluminum Can | 8 ounces (236 g) | 11.3 g | 21:1 | 4.7 g | 0.99 | 0.08 |
| Stand-up Flexible Pouch | 6.75 ounces (199 g) | 5.7 g | 35:1 | 2.8 g | 0.45 | 0.02 |

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.

Typical packaging photos courtesy of The Dow Chemical Company

# End-of-Packaging-Life Existing & Emerging Options, Opportunities and Challenges

The Flexible Packaging Association is leading an industry effort to address end-of-packaging-life alternatives for flexible packaging, including increasing resource recovery. Figure 1 describes various scenarios for managing flexible packaging waste (FPW).

At present "no one disposal scenario is most favorable for FPW across all environmental impact categories."*

## Existing Options

**Waste to Energy** – Waste to Energy (W2E) is responsible for about 3% of recovery in the United States and, despite its political unpopularity in the U.S., it brings significant value in the form of energy. The flexible packaging industry encourages further development of this option in the U.S.

**Mechanical Recycling** – Mechanical Recycling is a viable option for a package produced from a single-layer material, such as PE retail bags. It is currently not feasible to recycle multi-material packaging, because the current recycling processes are designed for heavier, thicker, and single-material packaging. Additionally, many single-material recycling infrastructures cannot handle "contaminated" packaging of any type such as food or motor oil packaging. Therefore, even packaging which can currently be recycled has limitations (see Table 2, Recycle Rates).

**Composting** – Biodegradable materials are designed to decompose "naturally" in the presence of microorganisms, water, light and oxygen. However, they are most often sent to landfill because there is limited composting infrastructure. Today's landfills are anaerobic, or "without oxygen" which prevents these materials from degrading effectively in a timely manner.

**Landfill** – Landfilling is currently the most viable option for packaging made of multi-material laminates. Although the majority of multi-material laminate packaging currently goes to landfill, it makes up only a small portion of the volume (1.6% of the total municipal solid waste stream). Table 2 illustrates packaging-to-landfill for various packaging options and, together with Table 1, demonstrates how, utilizing less energy and generating fewer greenhouse gas emissions, flexible packaging generally provides greater sustainability advantages than other packaging formats, even taking into account recycling rates.

**Table 2: Non-carbonated Beverage Packaging Grams to Landfill**

| Beverage Packaging | Product Weight | Packaging Weight | Packaging Weight per 100 g Product | Recycle Rate | To MSW Landfill | To Landfill per 100 g Product |
|---|---|---|---|---|---|---|
| Glass Bottle & Metal Cap | 8 oz. (236 g) | 198.4 g | 83.9 g | 34% | 66% | 55.4 |
| Plastic PET Bottle & Cap | 8 oz. (236 g) | 22.7 g | 9.6 g | 29% | 71% | 6.8 |
| Aluminum Can | 8 oz. (236 g) | 11.3 g | 4.7 g | 58% | 42% | 2.0 |
| Stand-up Flexible Pouch | 6.75 oz. (199 g) | 5.7 g | 2.8 g | 0% | 100% | 2.8 |

Source: FPA Case Studies, 2009; EPA 2010 MSW Report

*EarthShift/FPA *LCA of Three Types of Flexible Packaging and End-of-Life Options*

## Emerging Options for Resource Recovery

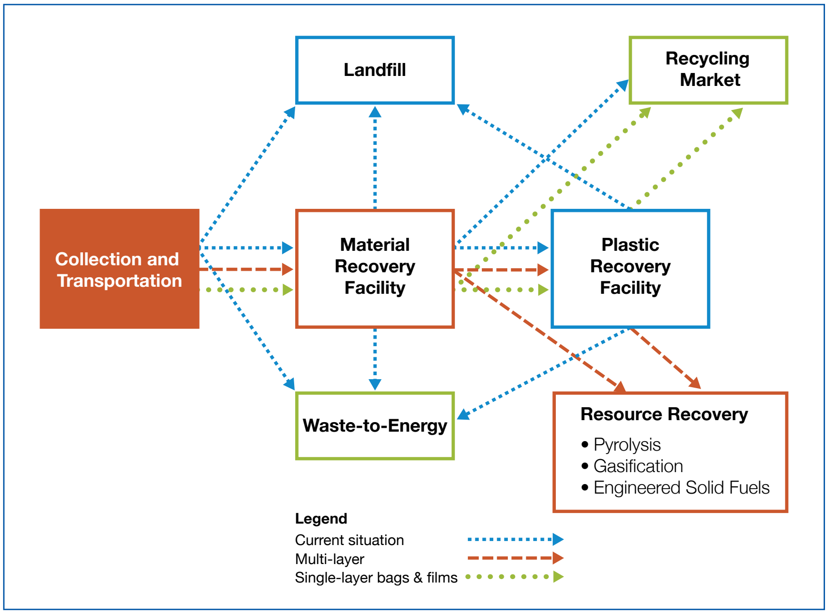
Resource Recovery, among the emerging end-of-packaging-life options, provides the opportunity for recovery of the energy that is contained in flexible packaging. These options include:

**Gasification** – This process converts feedstock into clean synthetic fuel gas, which can be used to generate electricity. Commercialization in the U.S. is in the early stages.

**Engineered Solid Fuels** – This process transforms plastics and other waste into fuel pellets which can be used to generate power. Commercialization in the U.S. is in the early stages.

**Pyrolysis** – This resource recovery technology transforms plastics, including multi-material laminates, to energy feedstock such as industrial wax, lube stock and synthetic crude oil. Smaller scale processing units and lower capital costs than gasification and engineered solid fuel plants make it an attractive option for the recovery of inherent energy from flexible packaging.

Figure 1: Managing Flexible Packaging Waste




Source: EEC Columbia University/FPA 2013

## Opportunities

- Recovering energy that is contained in flexible packaging materials
- Generating energy feedstocks
- Diverting materials from landfill to recover their energy value

To realize these opportunities, several current infrastructure challenges must be addressed.

## Challenges

There is no single solution to the best way to collect, sort and process flexible packaging waste. It will depend on multiple factors within each community, including:

- Volume
- Collection infrastructure
- Sortation infrastructure
- Processing
- Demand for recovered materials

Possible material flows are shown in Figure 2 (page 6).

**Volume** – The total volume of flexible packaging waste is only about 3.2% of the total U.S. annual municipal solid waste. Only about half of that (1.6%) is multi-material laminated flexible packaging (Table 3 and 4).

In spite of the low volume, the flexible packaging industry is working to identify and support viable end-of-packaging-life options.

Table 3: 2012 U.S. Flexible Packaging Volume

| | MM tons | % of MSW |
|---|---|---|
| Total Flexible Packaging Waste | 8 | 3.2% |
| Multi-Material Laminates | 4 | 1.6% |

Source: FPA Industry Segment Analysis, EPA 2011.

Table 4: Flexible Packaging Volume by Format

| Format | 2012 Volume (MM lbs.) | Hard to Recycle (MM lbs.) |
|---|---|---|
| Bags | 4,796 | 3,488 |
| Cut/Wrap | 254 | 254 |
| Flow Wrap | 53 | 53 |
| Wraps | 1,365 | |
| Lay flat/Pillow pouches | 3,321 | 3,321 |
| Standup pouches | 946 | 946 |
| Retort pouches | 16 | 16 |
| Lidding | 11 | 11 |
| Shrink bundling | 866 | |
| Stretch films | 938 | |
| Retail carry bags* | 2,212 | |
| Storage bags | 612 | |
| Trash bags | 1,129 | |
| Total (MM lbs.) | 16,519 | 8,089 |
| Total (MM tons) | 8.3 | 4.0 |

*Retail carry bags include both paper (949 MM lbs.) and plastic (1,263 MM lbs.)
Including sleeve labels would add an additional 817 MM lbs. to both columns.
Source: *Flexible Packaging Industry Segment Profile Analysis*,

**Collection** – There are currently no collection programs for multi-material laminates in the U.S. or Canada. However, there are many drop-off collection programs and several "bag in bag" curbside collection programs for single-layer flexible materials.

Collection scenarios for multi-material laminates include: at curbside with the other recyclables (single stream); a separate curbside pick-up for laminates; or at a drop-off depot.

- Curbside with other recyclables, laminates could be "bagged" or remain loose. Bagged laminates would be easier to pre-sort at the Material Recovery Facility (MRF). However, loose laminates would be easier for the consumer and potentially increase the collection rate.
- A separate pick-up could go directly to the processor, removing the sorting challenge, but collection cost could be higher.
- Laminates collected at a drop-off would by-pass the MRF and sortation challenge, but would require more effort on the part of the consumer.

A multi-material laminate collection pilot is currently being explored.

**Sortation** – Cost-effective sortation at the MRF is one of the biggest challenges facing multi-material laminates. Since laminates are not collected today, and MRFs only get small volumes inadvertently placed in bins by consumers, MFRs have very little experience handling them.

Currently manual, optical and vacuum-assisted sortation is used by MRFs to sort the small volume of laminates, films and bags. However, each of these methods has challenges at higher volumes. Additionally, the low volume of flexible packaging waste makes it challenging for MRFs to justify investing in new sorting technologies for these materials. Details on sortation can be found in Appendix A.

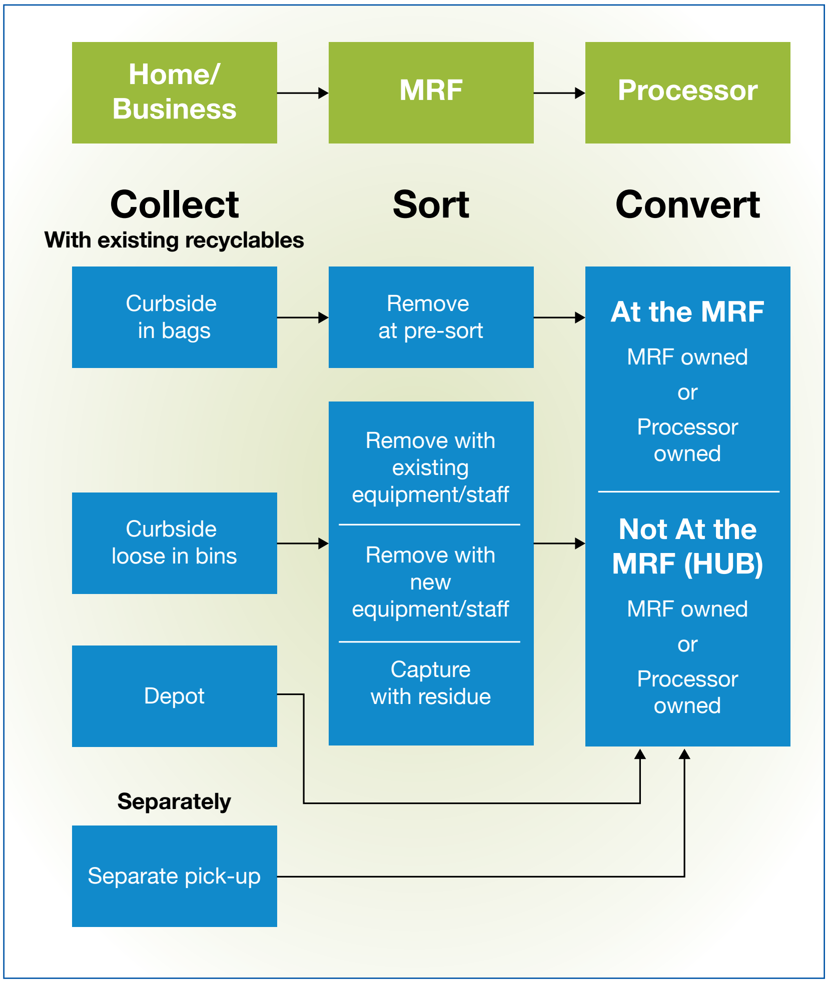
**Processing** – Currently pyrolysis appears to be a viable option for multi-material laminates.

- In pilots conducted by the Flexible Packaging Association on post-consumer flexible packaging waste, oil yield from pyrolysis was 70-80%.
- Processing can be done on-site by the MRF, or off-site by the processor.
- Location is critical because transportation costs can determine the cost viability of the processing technology.
- Volume continues to be a challenge for processing multi-material laminates. It would take a community of 6 million people, at a 20% collection rate, to fill a small commercial-size pyrolysis unit exclusively with multi-material laminates.

For more details on U.S. Pyrolysis Technology Providers, reference Appendix B.

**Demand for Recovered Materials** – For resource recovery systems to be viable there must be markets for the recovered products. Market pull will continue to advance as the emerging technologies become established and grow.

Figure 2: Flexible Packaging Collection, Sortation, Processing Material Flow Chart




Source: FPA 2014

**Viable Options** –There is no single solution that can be applied to all communities when it comes to the best way to collect, sort and process flexible packaging waste. Viability will be influenced by existing equipment and infrastructure, material collection methods and rates, volume and mix, and the relative location of the processor and demand for recovered material. Figure 2 shows potential "material flow" scenarios possible for a given community.

# Resource Recovery:
## Continuing the Journey

The Flexible Packaging Association is currently addressing resource recovery challenges. Engaging stakeholders is critical to the development of viable recovery options. Stakeholders include:

- Waste Management Companies
- Municipalities
- Non-Governmental Organizations
- Consumers
- Consumer Product Manufacturers
- Retailers
- Industry Associations

For details on stakeholder end-of-packaging-life programs and initiatives, reference Appendix C. For a list of FPA end-of-packaging-life research see back cover.

The FPA will continue researching and exploring pilots to further advance development of emerging resource recovery processes.

IT IS IMPORTANT THAT THE ENTIRE VALUE CHAIN WORK TOGETHER TO DEVELOP AND IMPLEMENT AN EFFECTIVE RESOURCE RECOVERY SYSTEM.

# Appendix

## Sortation Technology (Existing and in Development) Summary – Appendix A

| | Manual | Vacuum-Assisted Manual | Film Grabber | Air Separator | Optical-auto | Robotic |
|---|---|---|---|---|---|---|
| Purpose | Remove contaminants from the various material streams | Improves the volume (by 40%) and quality of flexible materials removed manually at picking stations | Designed to capture bags and very thin films | Separates residual paper from the container stream | Identifies and separates materials by type and is most commonly used to sort rigid plastics | Sorts multiple products by type vs. 1-2 for an optical sorter |
| Method | Manual pickers remove targeted materials by hand and redirect them into specific bins | Manual pickers lift flexibles into vacuum system positioned above belt at picking stations and redirect other materials into specific bins | Grabber fingers pass very close to belt to grab bags and thin films then retract to redirect material into bins. Large material must be removed prior to the grabber | Sucks flexibles to conveyor and redirects them | Uses infra-red or x-ray technology to map target materials and air to redirect them; materials need to be in a single layer on belt | Uses optical sorter to map target materials on suction belt and robotic arms to remove them. New models under development can include up to 10 arms. |
| Limitations | A limited volume of material can be handled by each picker | While greater than unassisted manual, the volume of material that can be handled by each picker is limited | Not effective for bag-in-bag, thicker films, or laminates; inadvertently captures significant volume of paper in single stream facilities | Can't distinguish between paper and flexible plastics or between different resins | Can't distinguish between rigid PE, flexible PE and laminates with a PE outer layer | Can only be used in low to medium throughput applications |
| Applicability to sorting laminates | Current method most commonly used for sorting laminates | Current method for sorting laminates in MRFs with this equipment installed | Laminates are too thick to be used with this equipment; it works with bags and thin films only where the effectiveness is only 40-60% | Potential to be used with laminates in a dual stream MRF where laminates are collected with the container stream | Could potentially be used with laminates although throughput and effectiveness are questionable especially in a heavy paper/laminate mix | Could potentially be used with laminates although the technology would need to be trialed to test effectiveness and throughput |

Note on costs:
The installed cost for the equipment listed above can range from $150,000 to well over $500,000 depending on the type, size, and throughput capacity required.
Sources: *Analysis of Flexible Film Plastics Packaging Diversion Systems* by Reclay StewardEdge for CPIA, *Continuous Improvement Fund, Stewardship Ontario*, March 2013
Demingling the Mix: *An Assessment of Commercially Available Automated Sorting Technology by 4R Sustainability for the ACC*, January 2011, direct interviews, and company websites

## U.S. Pyrolysis Technology Providers – Appendix B

| | Agilyx | Climax Global Energy | JBI Plastic2Oil | Vadxx | RES Polyflow |
|---|---|---|---|---|---|
| Location | Portland, OR | Blackville, SC | Niagara Falls, NY | Cleveland, OH | Akron, OH |
| Website | www.agilyx.com | www.climaxglobalenergy.com | www.plastic2oil.com | www.vadxx.com | www.respolyflow.com |
| Technology | Thermal pyrolysis | Microwave pyrolysis | Thermal pyrolysis | Thermal pyrolysis | Thermal pyrolysis |
| Outputs | Synthetic crude oil<br>Combustible gases<br>Char | Condensed Wax<br>Combustible gases<br>Char | Synthetic Fuel<br>Combustible gases<br>Char | Diesel additive<br>Combustible gases<br>Char | Synthetic crude oil<br>Combustible gases<br>Char |
| End Markets | Transportation fuels | Diesel fuel<br>Synthetic lubricant<br>Industrial wax | Heavy Fuel (no. 6)<br>Diesel fuel<br>Naptha | Diesel fuel | Diesel fuel<br>Octane enhancers<br>Fuel blend stocks |
| On-site Refining | No | No | Yes | No | No |
| Module Size | Gen 5 – 10-12 tons/day (4 vessel module)<br>Gen 6 – 50 tons/day (single reactor module) | 8 tons/day (single reactor module) | Gen 3 – permitted for 48 tons/day (single reactor module) Includes on-site refining | 60 tons/day | Gen 2 - 60 tons/day (single reactor module) |
| Feedstock | Waste Plastic | Waste Plastic | Waste Plastic | Waste Plastic | Waste Plastic<br>Rubber (10% max)<br>Carpeting (10% max) |
| Feedstock Limitations | Will accept limited amounts of PET and PVC. Nylon not a good feedstock | Will accept limited amounts of PET and PVC | Won't accept PET or PVC | Will only accept PET, PVC, and nylon in trace amounts | Rubber, carpeting and PVC limited to 10% of feed |
| Business Model | Client owned/ Agilyx operated & JV/Alliance | CGE owned/operated & JV/Alliance | | Vadxx owned and operated | Client owned/operated<br>Technology License |
| Pilot Facility | Tigard, OR<br>50 ton/day Gen 6 unit | Blackville, SC<br>8 ton/day unit | Niagara Falls, NY | Cleveland, OH | Perry, OH<br>60 ton/day Gen 2 unit |
| Commercial Plants | Three 16,000 ton/year Gen 5 installations<br>• Waste Management Portland, OR Agilyx operated<br>• Rational Energies Plymouth, MN License agreement<br>• GenAgain Atlanta, GA License agreement | Blackville facility has room for expansion<br>Plan to convert this pilot facility to a commercial facility<br>In the process of changing their name to HighWave Energy, Inc. | | In discussions with the city of Akron, OH for first commercial facility (8/13) | Pilot facility completed in Spring of 2013<br>Partnering with ENRETEC for west coast expansion<br>Plan to "commercialize" pilot facility<br>First client owned site expected to break ground in 2014 |
| Contacted by FPA | Yes | Yes | No Response | No Response | Yes |
| Visited by FPA | Yes | Yes | No | No | No |
| Last Updated | 10/16/13 | 3/18/14 | 3/21/14 | 3/21/14 | 11/7/13 |

Notes: Costs, Fees, and Efficiencies
- The cost the processor will pay for feedstock or conversely tipping fee the processor will charge to take feedstock into the facility depends upon the competitive landscape for the particular source of feedstock.
- Material headed for the landfill tends to be taken in at zero cost as the supplier avoids the cost of the landfill tipping fee.
- A tipping fee may be charged for highly contaminated material as the processor will incur cleaning costs or take a hit to oil conversion efficiencies.
- The processor may pay for very clean, high-quality material as it doesn't need to be cleaned and results in high oil conversion efficiencies. They may also be competing with other outlets for this material.
- Distillation equipment can be added to any of the process above if the client desires it.
- Economics are driven by oil conversion efficiency which is impacted by feedstock quality and moisture level; PET, PVC, non-plastic contaminates, and high moisture levels all negatively impact conversion efficiencies.

Source: FPA 2014, direct interviews, company websites, and press releases

# Summary of Stakeholder End-of-Packaging-Life Programs and Initiatives – Appendix C

| Organization | Initiative | Focus/Goal |
|---|---|---|
| **Industry Work Groups** | | |
| ACC | Flexible Film Recycling Group | To increase the recycling rate of PE bags & film |
| ACC | Plastics-to-Oil Technologies Alliance | To increase awareness of the benefits of plastics-to-oil technologies, enhance the industry's voice and build a network of allies |
| AMERIPEN | Packaging Recovery and Recycling Advocate | Material neutral approach to advancing the recovery of packaging with a focus on policy and best practice |
| CPIA | Film Recovery Working Group | To increase the diversion of plastic film from landfills through recycling and recovery (PE bags & film) |
| FPA | Flexible Packaging Resource Recovery Task Group | To facilitate the advancement of flexible packaging recovery with a focus on hard to recycle materials |
| FPI | Plastic Recovery Group, Paper Recovery Group | Create solutions for the recovery of plastic foodservice packaging in the U.S. and Canada |
| HPRC | Healthcare Plastics Recycling Council | Enable cost-effective recycling solutions for plastic products and materials used in the delivery of healthcare |
| PACNEXT | Material Optimization Committee | To improve recovery of high impact materials, to increase the value and utility of recovered materials |
| SPC | Flexible Packaging Recovery ILC | To investigate the options for recovering flexible packaging and work toward developing solutions |
| SPI | American Progressive Bag Alliance | To defend against plastic bag bans and taxes while proactively promoting the positives of bags |
| **Projects** | | |
| ACC | Plasticfilmrecycling.org | Web based tool to enable recycling of bags and film (on-going) |
| WI DNR, ACC, SPC | Wisconsin W.R.A.P | Recycling plastic film beyond bags, leverages Plasticfilmrecycling.org (Launched Feb 2013) |
| FPA | FPW Resource Recovery Project | Addressing the technology and economic challenges to the viable recovery of FPW (2013) |
| APR | Design-for-recycling guidelines for film | 20 APR members drafting design-for-recycling guidelines for film including 10 separate draft bale specifications (June 2013) |
| American Progressive Bag Alliance | A Bag's Life – Reduce, Reuse, Recycle | Public educational campaign in FL, PA, GA, NY, NC, TX, VA, LA promoting the 3 "R's" as they relate to bags and films. Includes a zip code recycle center locator |
| **Pilots/Trials** | | |
| FPA | FPW Alternative to Landfill Pilot Trials | Ran both pre and post consumer FPW through pyrolysis and engineered solid fuel processes (2011) |
| ACC | Curbside Collection pilot for non-recycled plastics (proposed) | Proposed U.S. collection pilot to include both rigid and flexible hard to recycle plastics (2014) |
| ACC, FPI, APR, NAPCOR, Carton Council | MRF Material Flow Study | Track material flow through the MRF for various materials (Feb 2014) |
| ACC, TIA, SPI, Agilyx | Integrated recycling and conversion of plastic toys to fuel | Plastics to fuel conversion for toys |
| HPRC | Pilot collection from healthcare environment | Largely focused on targeting PE and PP |
| HPRC | Health Care plastics recycling trials | Focused on surgical blue wrap, saline bottles, other pre-patient PE and PP items |
| Tetra-Pak | Experimentation in Coalition Building: Increasing Recovery | Develop customized action plans for targeted communities in TN and NC to address the key barriers to recovery performance |
| SERDC | SERDC 120: Increasing Recycling Rates | Develop plan to apply collection best practice to targeted cities to increase recycling in the SE region (flexibles not included in this phase, only currently collected materials) (Jan 2014) |
| **Municipal Work Groups** | | |
| WI | WI Council on Recycling Plastics Recycling Sub-committee | To develop recommendations to spur economic growth and jobs in WI through increased plastics recycling |
| OR | Oregon DEQ plastics recovery workgroup | Developing a long-term strategy for increased plastics recovery in Oregon |
| **Municipal Programs** | | |
| NYC | New York City Solid Waste Management Plan | Expanded recycling program to include all rigid plastics, program does not include flexibles. (bags, film, or laminates) |
| Seattle | Seattle Recycling Program | City of Seattle accepts PE bags curbside (it does not accept laminates), King County does not accept bags or laminates |
| San Francisco | San Francisco's Zero Waste Program | Mandatory recycling and composting. Do not accept any flexibles (bags, films, or laminates) |
| **Collection Best Practice** | | |
| AMERIPEN | Product Recovery Knowledge Map | Interactive web based knowledge mapping tool |
| AMERIPEN | 100 Cities Survey | A study that examined best practices for recovery of used packaging across the nation's 100 largest cities |
| AMERIPEN | Recovery Strategies and Financial Platforms Report | A study that identifies the most effective strategies and financing mechanisms used across the globe in recovering packaging waste |
| **Alternative Collection/Recovery Models** | | |
| Carton Council | Carton Recycling Program | Facilitates the recycling of cartons by providing optical sorters to MRFs, marketing materials/collection tools to communities, and providing a stable end market for the recovered material |
| TerraCycle | Brigades® collection program | Individuals and groups collect and ship material to TerraCycle for recycling, cost is subsidized by participating brand owners |
| **Recycling Rates** | | |
| ACC | Postconsumer Plastic Bag & Film Recycling Report | Reports on the volume of plastic bags and film recovered in the United States for recycling |

Organization Index: ACC: American Chemistry Council; AMERIPEN: American Institute for Packaging and the Environment; APR: Association of Postconsumer Plastics Recyclers; CPIA: Canadian Plastics Industry Association; FPA: Flexible Packaging Association; FPI: Foodservice Packaging Institute; HPRC: Healthcare Plastics Recycling Council; NAPCOR: National Association for PET Container Resources; SERDC: Southeast Recycling Development Council; SPC: Sustainable Packaging Coalition; SPI: Society of the Plastics Industry; TIA: Toy Industry Association; WI DNR: Wisconsin Department of Natural Resources
Source: SPI, AMERIPEN, FPA 2014

# FPA End-of-Packaging-Life Research

The Flexible Packaging Association is continuing its work on the sustainable advantages of flexible packaging including addressing end-of-packaging-life challenges and opportunities. Some of our research is listed below.

- **Continuing Evaluation of Resource Recovery Infrastructure and Processes**, Thira Group/FPA 2013-2014
- **End-of-Life Overview and Recovery Options**, Resource Recycling Systems/FPA 2013
- **Flexible Packaging Industry Segment Profile Analysis**, PTIS/FPA 2013
- **Flexible Packaging Association: LCA of Three Types of Flexible Packaging and End-of-Life Options**, EarthShift/FPA 2013
- **Economics of Collection and Processing Flexible Packaging Waste to a Feedstock for Pyrolysis**, EEC Columbia University/FPA 2013
- **Flexible Packaging Resource Recovery Alternative to Landfill Pilot Program**, Thira Group/FPA 2012
- **Identification and Assessment of Available Technologies for Materials and Energy Recovery from Flexible Packaging Waste**, EEC Columbia University/FPA 2011
- **Sustainability Solutions: Examples of the Environmental Advantages of using Flexible Packaging**, FPA 2010
- **Flexible Packaging Fast Facts – Less Resources. Less Footprint. More Value.**, FPA 2010
- **Sustainability Assessment of Flexible Packaging**, Battelle Memorial Institute/FPA 2009

For more details regarding our ongoing research and involvement in resource recovery, visit the Flexible Packaging Association web site www.flexpack.org.

Less Resources. Less Footprint. More Value.℠
Flexible Packaging

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