## Report

# Wisconsin Plastics Recycling Study

**Project I.D.: 12W025**

## Prepared for
## Wisconsin Department of Natural Resources (DNR)

**October 2012**

WISCONSIN
DEPT. OF NATURAL RESOURCES

Foth

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October 31, 2012

Cynthia Moore, State Recycling Coordinator
Wisconsin Department of Natural Resources
Materials Management
101 South Webster Street
PO Box 7921
Madison WI 53707-7921

RE: Final Report *Wisconsin Plastics Recycling Study*

Dear Cynthia:

We are pleased to submit this final report *Wisconsin Plastics Recycling Study*. The full report is contained within three separate documents: the Final Report, Appendices, and Executive Summary.

It was a pleasure serving the DNR on this *Study.*

Thank you

Sincerely,

Foth Infrastructure & Environment, LLC

Warren Shuros
*Client Director*

Dan Krivit
*Senior Project Manager*

cc: Patty Moore, President of Moore Recycling Associates

# Wisconsin Plastics Recycling Study: Options for Improvement

Project ID: 12W025

Prepared for

**Wisconsin Department of Natural Resources**

**(DNR)**

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PO Box 7921
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Prepared by

**Foth Infrastructure & Environment, LLC**

Together with

**Moore Recycling Associates, Inc.**

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# Wisconsin Plastics Recycling Study

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Under Separate Cover

# Wisconsin Plastics Recycling Study

## Executive Summary

Imagine if Wisconsin's citizens regularly threw away dollar bills in their garbage, and those dollar bills were taken to landfills and permanently buried in mountains of waste. We would surely react by saying "Please, separate out those dollar bills from your garbage and spend them at Wisconsin businesses." Those businesses would be only too glad to put those recovered dollars to immediate and productive use in the economy. This would create jobs and help the economy grow.

This scenario is a very close analogy to what is actually happening in Wisconsin with respect to used plastics. Used plastics have real monetary value to processors and manufacturers within Wisconsin. Yet despite a comprehensive statewide recycling program and a strong recycling ethic, hundreds of tons of valuable plastics are sent to Wisconsin landfills every day. The market value of used plastics sent to the landfill in 2009 alone was about $64 million.

This study identifies actions that can be taken now to keep valuable plastics out of Wisconsin landfills and put them to productive use, thereby creating jobs and boosting economic development in Wisconsin. In addition to the benefits to businesses and employment, increasing plastics recycling would provide environmental benefits by prolonging the life of landfills and reducing pollutant emissions. Specifically, this study enumerates actions Wisconsin can take to:

- Double the tonnages of polyethylene terephthalate (PET) and high-density polyethylene (HDPE) bottles, the most recyclable and valuable of all the plastic materials currently being landfilled, that are available to processors and manufacturers.

- Increase by a factor of 10 or more the tonnage of film plastics, including plastic bags, which are recovered for recycling.

- Substantially increase recycling of non-bottle rigid plastic containers and other rigid plastics, particularly those with higher market value such as PET, HDPE and polypropylene (PP).

- Extract value from truly non-recyclable plastics by salvaging them for energy recovery.

The study identifies specific strategies that could increase the tonnage of plastics recovered by 100,000 tons annually and stimulate job growth by several hundred new jobs. The strategies could be adopted individually or as a coordinated approach. The degree of success in attaining this rate of additional plastics recovery will depend on the aggressiveness of policy decisions and actions adopted.

## Background

The Wisconsin Department of Natural Resources (DNR) Bureau of Waste and Materials Management conducted a waste characterization study in 2009 to identify opportunities to better manage the state's waste and material resources and substantially reduce the impact of waste disposal. The study revealed that fully 14 percent (by weight) of the waste stream was used plastics. The market value of these plastics, including PET and HDPE bottles and jars and polyethylene (PE) film, was estimated at about $64 million. The DNR contracted with Foth Infrastructure & Environment, LLC, together with Moore Recycling Associates to assess the potential to grow Wisconsin's economy through increased recycling of plastics.

## Current Situation

Despite the high percentage of the US population that has access to PET and HDPE bottle recycling services, national studies indicate that the recycling rates are still relatively low for these and other high value, high volume recyclable plastics. Recycling rates for specific types of plastics in Wisconsin are not available, but are believed to be similar to national rates which range from a high of almost 30 percent for high value plastics to a low of 2 percent for lesser value plastics.

Wisconsin's comprehensive recycling law is widely supported by Wisconsin citizens and by the legislature through annual appropriations for recycling grants to local government recycling programs. The cornerstone of the law is a series of disposal and incineration bans on a variety of materials including plastic containers. The disposal ban on plastic containers went into effect in 1995. DNR granted a waiver for all containers except PET and HDPE bottles, due to inadequate markets infrastructure at the time. The waiver remains in effect today despite advances in the plastics recycling industry that support recycling of a much wider variety of plastic types.

Eighty-five registered materials recovery facilities (MRFs) throughout Wisconsin sorted and prepared for market about 34,000 tons of plastic containers in 2010. This MRF infrastructure is continuously increasing in capacity, and is steadily being upgraded with state of the art automatic sorting equipment to increase efficiency and bale quality and range of plastic types recycled. There is also a separate but growing infrastructure for voluntary recycling of clean plastic film, wraps and bags through public drop-off programs at retail stores.

Despite the maturing recycling infrastructure, a statewide system of comprehensive community recycling programs and a strong recycling ethic among Wisconsin citizens, the majority of plastics continue to make their way to the landfills each year at a very substantial economic loss to the state.

## Barriers to Plastics Recycling

Growth in Wisconsin's secondary plastics industry is constrained largely by a lack of supply assurance, an essential ingredient for new or growing companies and financing for capital investment. Increasing the amount and quality of recyclable plastics diverted from the waste stream through government and private efforts would effectively address this barrier. This study lists 27 market facilities located in Wisconsin including companies defined as reclaimers that sort, wash, grind, pelletize or compound the recyclable plastic and end-use manufacturers that

produce a final recycled plastic product or package. Results from interviews and other sources indicate there is more than adequate market capacity to absorb additional clean, sorted PET, HDPE and PP containers and clean PE film. Domestic markets for polyvinyl chloride (PVC) and polystyrene (PS) are more limited.

Barriers to increasing plastics recycling arise from the inherent complexity of plastics recycling due to the wide variety of plastic resin types and need for an uncontaminated product by end-use markets. Financial and technical barriers limit the ability of smaller MRFs to accept a wider range of the emerging plastic types or convert to a more consumer-friendly single stream collection system. This leads to variations in recycling programs, leaving consumers confused over what can and can't be recycled and how to recycle. Continuing gaps in "away from home" recycling services create an additional barrier, both in terms of reduced recovery of materials and in undermining the recycling ethic.

## Job Growth Potential and Economic Development Resources

Plastics recycling is an established growth sector that is poised for a calculated investment in accelerated market development. Key factors arguing for immediate investment include: strong industry demand for recycled plastics that currently exceeds supply, well-developed technologies to increase recycling rates, and advances in processing technology opening the door for cost-effective recycling of multiple types of plastics. A number of Wisconsin manufacturers have the capacity for further growth but are constrained by the lack of secure and steady supplies of clean, sorted recyclable plastics. Foreign export markets for recyclable plastics are expected to decrease in relative importance, creating the opportunity to grow Wisconsin's markets and processing capacity.

Plastics recycling can be a significant contributor to economic and job development potential. One study found that about 25 jobs are created for every plastics reclaimer, with average annual receipts of about $2 million per year. Wisconsin's plastics industries (including manufacturers that use virgin resins only) employ about 39,800 people and maintain a direct payroll of $1.6 billion. Plastics-dependent industries add another $12.9 billion to the state's payroll. Within the U.S., Wisconsin is ranked 8th among all states in plastics industry employment.

In addition to recycling, alternative recovery technologies (e.g., waste to energy; plastics to oil) have the potential to utilize large quantities of non-recyclable waste plastics that are either too contaminated to be used as manufacturing feedstock or do not have sufficient end-use recycling markets. Recovering these non-recyclable materials and putting them to productive use would provide additional opportunities for economic development and entrepreneurship.

This study found that Wisconsin offers an impressive array of resources to facilitate efforts to grow Wisconsin's plastics reclamation and manufacturing sector. The principal relevant economic development organizations begin with DNR's own Green Tier program and encompass local municipal agencies, the Wisconsin Economic Development Corporation (WEDC), the Wisconsin Manufacturing Extension Partnership (WMEP), and the Northwest Wisconsin Manufacturing Outreach Center (NWMORC). The report identifies a wide variety of specific programs that may be available to public or private entities to support economic

development investments. In addition, the report describes the available directories and materials exchanges that plastics industry participants can use to identify market opportunities.

## Potential Action Steps

This report identifies 40 actions for improving plastics recycling in Wisconsin. Among these are certain key actions for the next stage of implementation planning, such as:

- Establish ambitious plastic diversion planning targets (e.g., an additional 100,000 tons per year) by the year 2020 together with interim goals.
- Continue investing in the local responsible unit (RU) recycling programs as the primary building block for increasing collection of plastics. Develop clear recommendations for the largest RUs on how each can improve their plastics recycling program.
- Form a Wisconsin Plastics Recycling Council, with strong industry participation, to help implement these and other new initiatives.
- Hire a temporary market development specialist to focus and coordinate efforts to increase plastics recycling in Wisconsin.
- Disseminate this study and use it as a platform to develop, with industry input, a more detailed plastics recycling implementation plan and to improve coordination between government and the plastics industry.
- Conduct two detailed feasibility studies on the development of plastics recycling facilities to determine the scale, scope and economic potential of new operations to sort and reclaim two types of plastics:
  - Mixed rigid plastic containers (beyond PET and HDPE bottles); and
  - Plastic film/bags.

The remaining action options are classified into three broad planning scenarios, each with varying levels of government intervention. These scenarios are defined in this study for purposes of planning and comparison. Several of the options have elements within each scenario. The scenarios are not mutually exclusive; elements of each scenario could be implemented.

**The Status Quo Scenario:** Rely on prevailing industry trends to support growth in plastics recycling in Wisconsin. Some trends are favorable to gradual growth: the continued adoption of single-stream collection, the gradual upgrading of equipment at MRFs such as automatic sorting machines, development of more effective labeling standards for plastic packaging, and a broadening over time of accepted plastic materials in collection programs driven by consumer demand.

**The Partnership-Oriented Scenario:** Implement a series of government initiatives and foster voluntary private sector actions, including a diverse and comprehensive mix of measures that generally avoid legislation or other mandates. This scenario anticipates that both private and public investments will be made to increase recycling, including enhanced public education as a basis for other capital and operating improvements.

Examples of new program initiatives include:

- Promotion of a phased increase in municipal curbside and drop-off recycling programs, e.g.:
  - Phase One: All plastic bottles by the end of 2014.
  - Phase Two: All rigid plastic containers by the end of 2016.
- An enhanced plastic film and bag recycling program that could include further research to characterize current recyclable supplies and disposal systems and/or enhanced film/bag recycling system development such as the Flexible Film Recycling Group pilot programs.
- Enhanced supply assurance mechanisms developed by both business-to-business and government initiatives.
- Public-private partnerships that would enhance "away from home" recycling collection systems.
- Enhanced government procurement policies and actual purchase of recycled plastic products.
- Voluntary investigation by the private sector into the feasibility of development of a plastics-to-oil (PTO) facility in Wisconsin to recover residual and other waste plastics that are not recyclable.

**The Policy-Oriented Scenario:** Institute policy options including container deposits, phased removal of the disposal waiver for all bottles and all rigid containers, additional landfill surcharges and material "take back" requirements. The diversion planning targets under the partnership-oriented scenario are conceived as triggers for consideration of some combination of these mandates; if adequate progress is not successful under the partnership-oriented, then the mandates could be forwarded for legislative consideration.

While controversial, container deposits warrant further and serious consideration. Container deposits universally achieve high recycling rates, in some cases as high as 85 to 90 percent. If Wisconsin were to require container deposits on all beverage containers, and take no other action, it could recycle almost 16,000 tons of additional high-demand plastics. Deposits and municipal curbside / drop-off systems can be compatible when the proposed deposit legislation is designed to maximize recycling and minimize negative economic impacts on municipal programs. In addition to substantially increasing the tonnages of recyclable plastics available to Wisconsin processors and manufacturers, a Wisconsin container deposit program could generate about $60 million in unredeemed deposits that could be re-invested back into the recycling infrastructure.

## Conclusion

Wisconsin is well-poised to substantially improve plastics recycling rates. The right combination of actions identified in this study could offer a platform for significant progress on the challenge of supporting jobs and economic growth through enhanced recovery of plastics. Public-private partnerships will play a significant near-term role in the enhancement of plastics recovery.

# Wisconsin Plastics Recycling Study

## List of Abbreviations, Acronyms, and Symbols

| | |
|---|---|
| ACC | American Chemistry Council |
| ADF | Advanced disposal fee |
| AKA | Also known as |
| APR | Association of Postconsumer Plastic Recyclers |
| ASTM | ASTM International,<br>(formerly known as the American Society for Testing and Materials) |
| B2B | Business to business |
| CAP | Compliance Assurance Plan |
| CRI | Container Recycling Institute |
| CRV | California Redemption Value |
| DATCP | Wisconsin Department of Agriculture, Trade & Consumer Protection |
| DFR | Design for Recyclability |
| DNR | Wisconsin Department of Natural Resources |
| EPR | Extended producer responsibility |
| EPS | Expanded Polystyrene, including foamed PS for food service containers and "block & shape" packaging material used in boxes for protecting consumer goods during shipping (e.g., electronic goods). |
| EVA | Ethylene vinyl acetate |
| FFRG | Flexible Film Recycling Group (A program of ACC) |
| FTE | Full Time Equivalents (units for planning and budgeting program staffing levels) |
| Foth | Foth Infrastructure & Environment, LLC |
| HDPE | High Density Polyethylene |
| ISRI | Institute for Scrap Recycling Industries |
| LDPE | Low Density Polyethylene |
| LLDPE | Linear Low Density Polyethylene |
| Moore Recycling | Moore Recycling Associates, Inc. |
| MRFs | Material Recovery Facilities |
| MSW | Municipal Solid Waste |
| NAPCOR | National Association for PET Container Resources |
| NRC | National Recycling Coalition |

| | |
|---|---|
| NWMOC | Northwest Wisconsin Manufacturing Outreach Center |
| PCR | Postconsumer resin |
| PE | Polyethylene |
| PET | Polyethylene Terephthalate |
| PET-G | Polyethylene Terephthalate, Glycol-modified |
| PLA | Polylactic Acid (a biodegradable resin) |
| PP | Polypropylene |
| PS | Polystyrene |
| PTO | Plastics to oil |
| PVC | Polyvinyl Chloride |
| R&D | Research and Development |
| RAM | Recycling Association of Minnesota |
| RIC | ASTM International's Resin Identification Code system for consumer plastic packaging |
| RU | Responsible Unit (a designated local government agency responsible for recycling planning and implementation per Wisconsin State statutes) |
| SHWEC | University of Wisconsin Extension<br>Solid & Hazardous Waste Education Center |
| SPC | Sustainable Packaging Coalition |
| SPI | Society for the Plastics Industry |
| U.S. | United States of America |
| Wis. Adm. Code | Wisconsin Administrative Code |
| WisDOT | Wisconsin Department of Transportation |
| Wis. Stats. | Wisconsin Statutes |
| WTE | Waste to Energy |

# Wisconsin Plastics Recycling Study

## Definitions

| | |
|---|---|
| Agricultural film | PE film used for covering farm commodities and materials. Sometimes defined as "clean ag film" (does not touch the ground with up to 10% contamination) and "dirty ag film" (touches the ground with up to 30% contamination). Does not include PP-woven bags which are a separate category of film scrap. |
| Allowables | Unwanted items that inadvertently are included within a specified recyclable plastic bale (AKA "contaminants" and "prohibitives"). |
| Blister packs | One of several types of pre-formed plastic packaging used for small consumer goods, foods, and pharmaceuticals. The primary component of a blister pack is a cavity or pocket made from a formable web, usually a thermoformed plastic.<br>Also: "'Blister pack' means a container in which an item has a covering of plastic film or preformed semi-rigid plastic and the covering is affixed to a rigid backing." (Section 100.33(1)(ad), Wis. Stats.) |
| Bulky rigids | Any large, rigid, postconsumer, bulky plastic item removed in an initial positive sort from a curbside, drop-off, or other public or private recycling collection programs. Typical bulky rigid items are carts, crates, buckets, baskets, toys, lawn furniture, etc. These items are typically manufactured from HDPE, PP or LDPE. |
| Clamshell containers | A one-piece container consisting of two halves joined by a hinge area which allows the structure to come together to close. Clamshells are often made of a shaped, plastic material, in a way that is similar to a blister pack. Clamshell containers can be made of a variety of plastics such as PS, PE, PVC, foam sheets, etc. |
| Compliance Assurance Plan | As required by chapter NR 544.04(9g), Wis. Adm. Code. |
| Converters | Plastic converters convert recycled plastic flake or pellets into an intermediate material (e.g., sheet) or end products (e.g., packaging, pipe, fiber carpet or clothing). |
| Disposal | The intentional wasting of materials in mixed solid waste delivered to landfills or resource recovery facilities as defined by Wisconsin statutes and administrative rules. |
| Effective Recycling Program | A term under the *Wisconsin Recycling Law* that means a recycling education, collection, processing and marketing program that meets the standards of s. 287.11, Wis. Stats. and chapter NR 544, Wis. Adm. Code. |
| HDPE – colored (AKA: "HDPE Pigmented") | HDPE bottles and non-bottle containers with pigmented color (e.g., bottles for laundry soap, syrup, orange juice). Sometimes called "co-polymer" HDPE. |
| HDPE - natural | HDPE bottles without pigmented color (e.g., water jugs, white milk jugs). The technical term sometimes used is "homo-polymer" HDPE. |
| Lids | Caps for tubs that have a fastening feature other than threads. |
| MRF | Material(s) Recovery Facility, a place where recyclables collected from curbside |

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| | routes are sorted and baled for sale or further processing. |
| Polyolefin | A plastic polymer produced from a simple olefin as a monomer. For example, PE is the polyolefin produced by polymerizing the olefin ethylene. (AKA polyalkene.) Polypropylene is another common polyolefin which is made from the olefin propylene. |
| Postconsumer | Products and materials that have been used for their intended purpose and then directed to disposal. |
| Postconsumer resin (PCR) | Cleaned, processed flake or pellets made from postconsumer recyclable materials. |
| Reclaimer | Companies that transform recyclable plastics directly into intermediate products (e.g., plastic lumber) or raw materials (e.g., pellets or granulated flake) ready for remanufacture by other companies. Reclaiming activities include separating, washing, grinding, flaking and pelletizing. |
| Recyclable plastic | Plastic bottles, non-bottle containers, film/bags and bulky rigid items that have been sorted for recycling, regardless of form (e.g., loose, baled, commingled with other recyclables), before processing into recycled resin. |
| Recycled plastic | Plastic products or materials made from recycled items. This is a more generic term and can include post-industrial and well as postconsumer recycled resin. |
| Recycled resin | Plastic resin in the form of flake or pellets made from recyclable plastic. |
| Resource recovery | The recovery of compost, energy or other by-products through technologies such as composting, waste to energy and plastics to oil. |
| Responsible Unit | A term under the *Wisconsin Recycling Law* meaning a municipality, county, federally recognized Indian tribe or band, or other solid waste management authority under s. 59.70(2), Wis. Stats., designated under s. 287.09 (1), Wis. Stats. |
| Shrink wrap | A plastic film material used for storage and shipping. When heat is applied, it shrinks tightly over whatever it is covering. The most commonly used resin types are polyolefins. Other shrink films include PVC and several other composites. |
| Stretch film | A highly stretchable plastic film that is wrapped around items to prepare items for shipping (AKA “pallet wrap). The elastic recovery keeps the items tightly bound. In contrast, “shrink wrap” is applied loosely around an item and shrinks tightly with heat. Stretch film is frequently used to unitize pallet loads but also may be used for bundling smaller items. The most common stretch wrap resin material is LLDPE. |
| Thermoforms | Plastic containers and packaging (e.g., blister packs and clamshell containers) made from a manufacturing process in which a plastic sheet is heated to a pliable forming temperature, formed to a specific shape in a mold, and trimmed to create a usable product. Thermoforming differs from injection molding, blow molding, rotational molding, and other forms of processing plastics. |
| Tubs | (Non-bottle) containers that have a neck or mouth that is similar in size to the base. |

# Wisconsin Plastics Recycling Study

## Acknowledgements

This *Wisconsin Plastics Recycling Study* was produced with the assistance of many other individuals and organizations. The project was commissioned under the direction of the Wisconsin Department of Natural Resources (DNR), Waste and Materials Management, Recycling and Solid Waste Section. The Consultant Team thanks Cynthia Moore, the DNR Project Manager, as well as Brad Wolbert, DNR Section Chief. Other key DNR staff that assisted with the guidance and review of this report include, Mark McDermid, Bureau Director of the Cooperative Environmental Assistance program.

DNR staff assembled a team of advisors to help with document review; including: George Dreckman, City of Madison Recycling & Solid Waste Coordinator; and Joe Van Rossum, University of Wisconsin Extension, Solid & Hazardous Waste Education Center.

The project team interviewed a wide variety of public and private organizations to gather further insights into current plastics recycling operations and potential opportunities for improvement. Listed in alphabetical order by organization, the following individuals were interviewed:

- Cory Tomczyk, IROW (formerly known as the Industrial Recyclers of Wisconsin)
- Matthew Mikolajewski, City of Madison
- Charlie Romines, City of Madison
- Mike Rekitzke, N.E.W. Plastics Corp. (also doing business as RENEW plastics, Inc.)
- Larry Blackledge, Northwest Wisconsin Manufacturing Outreach Center (NWMOC)
- Jill Haygood, Outagamie County
- Phil Stecker, Outagamie County
- David Pellitteri, Pellitteri Waste Systems
- Dan Mohs, Placon Corporation (also doing business as EcoStar Plastics)
- Bill Rubick, Printpack, Inc.
- Dave Heglas, Trex Company
- Mike Lunow, Waste Management
- Lynn Morgan, Waste Management
- Brenda Hicks-Sorensen, Wisconsin Economic Development Corporation (WEDC)
- Lee Swindall, WEDC
- David Volz, WEDC
- Pete Emenecker, Wisconsin Film & Bag
- Randy Bertram, Wisconsin Manufacturing Extension Partnership (WMEP)

Moore Recycling Associates served as an invaluable part of the consultant team throughout the project; including: Patty Moore, Nina Bellucci Butler, and Melanie Luque.

# 1 Introduction

The Wisconsin Department of Natural Resources (DNR) Bureau of Waste and Materials Management contracted with Foth Infrastructure & Environment, LLC (Foth), and with Moore Recycling Associates (Moore Recycling) as a subcontractor, to study plastics recycling in Wisconsin. The results of this study will serve as the basis for developing policy options to stimulate economic development and the growth of recycling-related jobs in Wisconsin through increased recycling of plastics.

## 1.1 Purpose

The State of Wisconsin has one of the leading recycling programs in the nation. Many pioneering initiatives to plan, design, implement and expand recycling for Wisconsin residents and businesses have been in place for over two decades. Yet recent waste composition studies indicate that a large amount of recyclable plastic is still being disposed of in landfills. DNR has the primary role to plan and manage the State's recycling and waste programs. One element of the statewide program is a series of landfill disposal bans which have included PET and HDPE plastic bottles since 1995. The plastics recycling industry has continued to grow and develop over the past 30 years such that a much wider variety of types of plastics are now recycled in certain communities.

DNR is investing in this independent study to provide additional background research and policy suggestions to help increase the supply and improve the quality of recyclable plastic for use by the plastics industry. Recycling is an economic driver in Wisconsin, responsible for business development and jobs for Wisconsin companies and residents. Wisconsin's plastics industries overall employ about 39,800 people and with a direct payroll of $1.6 billion. The plastics recycling industry is a key potential growth area in Wisconsin's economy. It is important to businesses and residents that Wisconsin take full advantage of any opportunities to increase the State's competitiveness in this industry. This study suggests how to leverage state programs and services to best support business and job growth.

In order to fully gauge the strengths of existing plastics recycling programs and opportunities for improving recycling programs in Wisconsin, this study assesses the private and public infrastructure in place to process, market and manufacture recycled plastics and identifies infrastructure needs and barriers to growth of the industry in Wisconsin.

## 1.2 Scope of Work

This study is focused on post-consumer, recyclable plastics from both residential and commercial sources that have been used for their intended purposes and then discarded for recycling or disposal. There are four general categories of post-consumer, recyclable plastics covered in this study:

- Bottles.
- Non-bottle, rigid containers (sometimes referred to simply as "containers").
- Bulky rigid plastics (e.g., carts, crates, buckets, baskets, toys, lawn furniture).
- Film, including plastic bags (e.g., grocery and other consumer bags).

The infrastructure for post-consumer plastics recycling includes collection, processing and end-use manufacturers. This study uses readily available information and data to describe each of these components of the overall plastics recycling system. A variety of public and private organizations own, operate and develop this infrastructure. Many state, regional and local government agencies are involved in this diverse recycling system. Because the increased economic and jobs development potential represented by improved plastics recycling is a key part of this study, a description of current government economic development agency roles and responsibilities is provided.

In general, this study does not analyze the recycling of post-industrial plastics that are generated as plant scrap. Such post-industrial plastic scrap material is more homogeneous and often generated from a single manufacturing facility in relatively high volumes. Therefore, this post-industrial plant scrap usually is recognized as a valuable asset, readily marketable and not disposed of as waste. Some recyclers will process both post-consumer plastics and post-industrial scrap. Therefore, the overall plastics market infrastructure, including processing capacities, is important to both sources of recyclable plastics.

Finally, the scope of this study is focused on the existing plastics recycling infrastructure that serves Wisconsin generators. This study does not address the feasibility of converting "virgin-only" plastic product manufacturing industries to include a share of recycled resin. The consultant project team recognizes there may be many virgin-only manufacturers that are candidates to convert to use of recycled resins if there is an adequate supply in terms of quantity, quality, price and reliable infrastructure. This additional research topic is recommended for further study.

Recycling is defined by State law and policy and, in general, means the remanufacturing of recyclable commodities into new products. Recycling does not include waste-to-energy processes, and by definition excludes other forms of converting plastics into fuel or constituent components (e.g., plastics to oil). However, these additional forms of plastics recovery do have an indirect impact on plastics recycling and therefore are addressed as an adjunct strategy in this study.

## 1.3 Regulatory Framework

### 1.3.1 Solid Waste Reduction, Recovery and Recycling Law and DNR's Administrative Rules

One of the key building blocks of the Wisconsin recycling system is the *Solid Waste Reduction, Recovery and Recycling Law*[1] (also known as "The Recycling Law," ch. 287, Wis. Stats.) and the related administrative rules promulgated by DNR (chs. NR 542[2] to 548[3], Wis. Adm. Code). State policy outlined in the law establishes a hierarchy of preferences for solid waste management options. [4]This hierarchy states that in the management of solid waste, whenever possible and practical, the state encourages the following priorities:

(a) The reduction of the amount of solid waste generated.
(b) The reuse of solid waste.
(c) The recycling of solid waste.
(d) The composting of solid waste.
(e) The recovery of energy from solid waste.

(f) The land disposal of solid waste.
(g) The burning of solid waste without energy recovery.

The Recycling Law also authorized a graduated series of disposal bans on landfilling and incineration of certain recyclable materials. In 1995, the Recycling Law banned the landfill disposal or incineration of plastic containers, along with other recyclable materials. Section 287.07(4), Wis. Stats., contains the general disposal restriction with respect to plastics:

> *"Beginning on January 1, 1995, no person may dispose of in a solid waste disposal facility, convert into fuel, or burn at a solid waste treatment facility in this state any of the following:*
>
> *(c) Foam polystyrene packaging.*
> *(i) A plastic container."*

The disposal restrictions are not absolute. Under s. 287.07(7), Wis. Stats., the prohibitions do not apply to solid waste that is generated in a region that has an approved effective recycling program as determined by the DNR. The prohibitions do, however, apply to recyclables that have been separated out from the trash, even in effective recycling programs. Once recyclables have been separated for recycling from wastes, they cannot legally be mixed back with solid waste and disposed of as waste.

Section 287.07(7)(h), Wis. Stats., allows the DNR to grant a waiver to the foam polystyrene or plastic container ban if the department determines all of the following:

> *"(a) Recycling of the material is not feasible or practical in light of current markets or available technologies.*
>
> *"(b) Granting the waiver or conditional waiver will not impede progress toward meeting the goals of the state solid waste policy under Wisconsin Statutes Section 287.05."*

If the DNR grants a waiver, it shall continue in effect until one year after the DNR determines that either recycling of the material has become feasible, or that the waiver impedes progress toward the goals of the solid waste policy. However, the DNR may not grant a waiver for PET or HDPE bottles as these commodities were already determined to be readily marketable as recyclable materials and therefore banned from disposal.

At the time the disposal restrictions went into effect, DNR determined that only PET and HDPE bottles had adequate markets and therefore issued a variance to the ban to allow continued landfill disposal or incineration of plastic containers with Resin Identification Codes (RIC) types #3 through #7 (i.e., PVC, LDPE, PP, PS and "other"). This variance included all forms of PS (RIC type #6) to be landfilled or incinerated. DNR also included PET and HDPE **non-**bottle containers in this same variance (e.g., thermoforms such as PET clamshells or injection molded containers such tubs, cups, and jars).

If at some future time the DNR determines that adequate markets and processing technologies exist for these other types of plastics covered under the variance, the variance may be lifted and

these other types of plastics would also be formally banned from disposal or incineration. This study provides a technical basis for DNR's current re-evaluation of this variance.

In addition, beginning on July 1, 2011, individuals are prohibited from throwing away recyclables (mandatory recycling). Section 287.07(4e) (a), Wis. Stats., states that:

> *"No person may place in a container… which will be disposed of in a solid waste treatment facility, converted into fuel, or burned at a solid waste treatment facility any plastic containers."*

Plastic containers are defined in s. 100.33(1)(c), Wis. Stats., as:

> *"An individual, separate, rigid plastic bottle, can, jar or carton, except for a blister pack, that is originally used to contain a product that is the subject of a retail sale…"*

The rules to implement the plastic container definition are administered by the Department of Agriculture, Trade & Consumer Protection (DATCP). The definition of "carton" includes an individual, separate, rigid plastic cup, if the cup is originally used to contain a product that is the subject of a retail sale. In the rules, "container" does not include:

(a) A container's lid.
(b) A tray originally used to contain meat or other foods for retail sale.
(c) A one quart or smaller mesh basket originally used to contain berries or other foods for retail sale.
(d) A container used to hold pesticides.

Under the definition of "plastic container", empty plastic cups sold at retail (such as those sold in quantities of 50 for picnics) are not required to be labeled under the *Wisconsin Plastic Container Labeling Law* (see discussion in Section 3.1.2 below) because they are not "originally used to contain a product that is the subject of a retail sale". On the other hand, empty plastic cups sold by a wholesaler to a retailer, which the retailer filled in order to sell a beverage, must be recycled. Solo™ cups, for example, when sold at a fair or concert, are required to be recycled under this statute.

HDPE and PET bottles, thermoform non-bottle containers, and cups sold at retail with a product inside (e.g., at an event), may not legally be thrown out for disposal. But if these items are mixed in with the regular trash, they can be legally landfilled or incinerated as long as they 1) have <u>not</u> been separated for recycling; and 2) they are generated in a municipality or county that has been deemed by the DNR to have an effective recycling program

Other plastic containers as well as foam polystyrene packaging can legally be thrown out for disposal because a DNR-issued waiver of the disposal bans is in effect for these materials.

Because the scope of the disposal bans still includes HDPE and PET cups and thermoforms, local recycling programs should be collecting these materials. In practice, because most

processors do not accept plastic cups and thermoforms, most programs do not collect them. The DNR is not currently enforcing the landfill bans against these items.

Recycling of the items that are banned from disposal is required at non-residential facilities and the local government recycling programs are required to provide information to commercial establishments. This should include local enforcement and compliance activities.

In 2006, the Recycling Law was amended to require each RU to develop a Compliance Assurance Plan (CAP) in partial fulfillment of the basic criteria for an effective recycling program. A CAP describes the procedures a RU will follow in order to assure local recycling regulations/ordinances are being complied with. In most cases, a RU's CAP will only be a matter of formalizing the steps currently taken by staff to address ordinance violations related to recycling. A response plan to gain compliance should provide for stepped measures/penalties. With each incident of non-compliance the response increases to the next level. For serious and /or repeat offenses, sometimes it is necessary for RUs to issue citations. RUs have this authority within the local recycling ordinances. [5] [6]

In theory, a CAP could be an effective means of ensuring compliance with recycling requirements among commercial facilities. In reality, however, planning and managing non-residential recycling programs is a very difficult and labor intensive effort to oversee and enforce. There are some individual success stories across the state of effective non-residential recycling efforts and there is certainly heightened awareness of the importance of recycling from commercial establishments. In general, however, commercial sector recycling component is widely acknowledged to need substantial improvement. The exception would be in cases where there is strong financial incentive to recycle, such as for cardboard containers which are commonly recycled by commercial establishments.

### 1.3.2 Wisconsin Plastic Labeling Law and Administrative Rules

In 1987, the Wisconsin Legislature first enacted the *Plastic Container Labeling Law* (s. 100.33[7], Wis. Stats.). Passage of this law was followed by rules promulgated by the Wisconsin Department of Agriculture, Trade & Consumer Protection (DATCP) in 1990 (ch. ATCP 137[8], Wis. Adm. Code). DATCP rules establish labeling requirements for plastic containers designed to provide information needed by operators of MRFs and other sorting facilities to facilitate the reclamation and recycling of specified plastic containers. The DATCP rules permit a manufacturer of plastic containers and a person who places products in plastic containers to choose an appropriate method of labeling plastic containers. DATCP made an effort to develop rules which were consistent, to the greatest extent practicable, with national industry-wide plastic container coding systems that were just being adopted at that time. Today, the current ASTM Resin Identification Code (RIC) system provides the standards for the industry-wide plastic container coding system (see Section 2.9).

### 1.3.3 Roles of State Agencies and Responsible Units

The State agencies (DNR and DATCP) determine the specific recyclables that are banned from landfill or other disposal in accordance with Wisconsin laws and rules as described above in Section 1.3.1. DNR has primary responsibility for managing the State's recycling program including providing grant and technical assistance programs authorized by the Recycling Law. DNR also has primary responsibility for market development efforts related to expanding the

supply and demand for recyclable materials. DATCP is responsible for administering the *Plastics Labeling Law*.

The *Wisconsin Recycling Law* delegates responsibility for implementing these bans to Responsible Units (RU's). A responsible unit can be a municipality, county, tribe, solid waste management system or other unit of local government that is responsible for planning, operating and funding a recycling program. As of 2011, there were about 1,060 RUs in the state, although the exact number fluctuates to a limited degree.

Each RU must develop and implement a recycling program to manage the banned materials. Every citizen in Wisconsin must have residential recycling service or drop-off centers within easy access and should be provided with recycling education and outreach. In addition to ensuring provision of recycling services to residents, RUs have the responsibility of ensuring banned materials are recycled at non-residential locations including businesses, institutions, special events and construction sites. RUs are not required by law to provide these services themselves. RUs are also charged with educating residents and businesses about state and local laws and ordinances.

The DNR is authorized to issue citations to and collect forfeitures from individuals and companies that violate the provisions enforced by DNR. In general, however, the DNR's implementation of the recycling law emphasizes achieving voluntary compliance through education and technical and financial assistance.[9]

## 1.4 Study Methods

The consultant project team of Foth and Moore Recycling used a collaborative approach of working closely with DNR staff to produce this report. DNR staff contributed background information, including recycling program data and descriptions. DNR utilized the additional expertise of other state agencies and local governmental units for advice and guidance (e.g., Wisconsin Economic Development Corporation; University of Wisconsin Extension, Solid and Hazardous Waste Education Center; City of Madison). Additional research, analysis, and conclusions were conducted on an independent basis by the consultant team only.

Chapter 2 contains a summary of an extensive review of relevant literature about the national plastics recycling systems. Additional documents, data and other unpublished information were also used to develop this section of the study.

Chapter 3, together with the accompanying appendices, comprises the description of existing plastics recycling systems in Wisconsin. This chapter describes the plastics recycling markets serving Wisconsin communities and businesses, including those located in neighboring states and more distant locations. Readily available data were obtained from DNR on the volumes and quantity of recyclable plastics collected from RUs and materials recovery facilities (MRFs) serving Wisconsin communities. Statewide waste composition studies and local recyclables capture rate studies were used to document current and potential "new" tons of recyclable plastics that may be available for recycling. Available national data were also provided by Moore Recycling to supplement state and local recycling rate data. Interviews were conducted with selected local governments, MRFs, markets and end-use manufacturers. These interviews helped the consultant team understand current operations, barriers to growth and opinions about alternative policy strategies to grow plastics recycling and related jobs in Wisconsin.

The final report was produced by Foth with assistance from Moore Recycling. The information presented is as accurate as possible given the limits of the data (see Section 1.5 below). The opinions and recommendations represent a consensus of the consultant team and do not necessarily reflect official policy of DNR or other state agencies.

## 1.5 Discussion of Data Limits

This study is based on the best data that are readily available for the intended analyses. This section discusses the limits of the data and leads to further discussion in Chapter 5 of alternative means to improve the existing report and data management systems.

The national background information presented in Chapter 2 is based on publicly available publications and previous plastics recycling studies. However, container and film production data are not available specific to Wisconsin. Likewise, production data are not readily available for all the types of plastics included in this study. Therefore, the critical issue of recycling rates (amount recycled compared to total production) by type of plastic is not possible.

Also, historical data on weight per unit (e.g., ounces per liter PET bottle) are not readily available, so the competing trends of "light-weighting" containers vs. changes in recycling rates cannot be distinguished in this report. It is difficult to document and analyze the relative impacts of each factor in the recycling industry because recycling is measured on a total tons recycled basis without regard to unit counts or size per unit. Clearly, the changing market mixes on the grocery store shelf and the composition of the containers (both resin type and weight per unit) have significant impacts on the tonnage of recyclable plastic available for recycling.

The U.S. Environmental Protection Agency (EPA) publishes a report on the estimated amounts and composition of solid waste and recyclable materials generated and recycled (see Section 2.2 for more discussion and details). The EPA categories for plastics do not match exactly with other industry publications. Therefore, except for a few commodities (e.g., "PET bottles & jars"; "HDPE – natural") recycling rates cannot be reliably compared using data from different research methods that use different recyclable plastics definitions and categories.

The recyclable plastics collection and processing data reported in Chapter 3 are derived primarily from RU and MRF (Material Recycling Facility) reports to DNR. DNR staff has indicated there are gaps in the reported recycling data[10] as follows:

- There is limited mandatory statewide recycling reporting. RUs and self-certified MRFs must report annually on the tonnages of recyclable materials collected and processed and some DNR solid waste approvals require reporting (e.g. shingles and other construction and demolition recycling facilities). Other than for electronics, there is no statewide reporting requirement for other recycling-related activities.

- MRFs that that accept recyclable material exclusively from non-RU sources are not required to report. For instance, MRFs that handle only post-industrial recyclables from businesses and industry are not required to report their recycling activity to DNR or any other state agency. MRFs that accept materials from RUs must also report their non-

residential tonnages, but this accounting does not address all the commercial recycling activity, which is may be quite significant.

- Commercial/industrial MRFs, or facilities that accept only one commodity, do not submit tonnage reports to the DNR. This primarily impacts reporting of paper collected for recycling but processed directly by a paper mill.

- Data from RU's and MRF's use separate report forms and may contain different data for similar reporting categories. Therefore, some of the data from recycling facilities is conflicting or incomplete.

- Without adequate tracking by source, there may be double counting of the same tons from RUs and MRFs. This is a challenge whenever there are multiple levels in a recycling system reporting from the same geographic location.

- There is no state requirement for facilities to report on commercial, industrial, agricultural, and other "away from home" recyclables collected. For example, bar and restaurant recycled materials are most often not reported.

- There is often no reporting of direct deliveries of recyclables by the commercial waste generator, or their private hauler, to private recyclers.

- There are no reliable data reported to DNR for recyclable film, non-bottle rigid containers, and other packaging materials that are not banned from disposal.

- There are challenges to improved data management. These challenges include, but are not limited to:

    - Low priority placed on recycling enforcement and reporting by RU's;
    - Costs to reporting entities (e.g., RUs and MRFs);
    - Costs to the State agencies (e.g., DNR);
    - Need for additional data quality control and assurance; and
    - Low response rates.

- There are no direct data on waste generation (e.g., total amounts of mixed trash and recyclables as discarded). Funding limitations have precluded the DNR from conducing waste generation and disposal studies since 2009.

Data year 2010 is used in Chapter 3 for the descriptions of existing RU and MRF systems. This data year was selected for purposes of consistency and completeness, even though more recent information is available for 2011, because the DNR reporting categories and definitions changed in 2011 and those data have not yet been fully verified and quality checked.

# 2 Background Information and National Trends

## 2.1 Introduction to Plastics Recycling

Plastics play an important role in almost every aspect of our lives. Plastics are used to manufacture everyday products such as beverage containers, toys, and furniture. The largest categories of plastics are found in containers and packaging (e.g., soft drink bottles, lids, shampoo bottles, bags, sacks and wraps), but they also are found in durable (e.g., appliances, furniture) and nondurable goods (e.g., diapers, trash bags, cups and utensils, medical devices).

Plastics can be divided in to two major subsets: thermosets and thermoplastics. A thermoset solidifies or "sets" irreversibly when heated. They are useful for their durability and strength, and are therefore used primarily in automobile and construction applications. Other uses include adhesives, inks, and coatings.

A thermoplastic softens when exposed to heat and hardens at room temperature. Thermoplastics can easily be shaped and molded into products such as milk jugs, floor coverings, credit cards, and carpet fibers.

The widespread use of plastics demands proper materials management including end of life management. According to the EPA, the recycling rate for different types of plastics varies greatly, resulting in an overall plastics recycling rate of only 8.2 percent, or 2.4 million tons, nationally, in 2010. However, the recycling rate for some plastics is much higher. For example in 2010, 28 percent of HDPE bottles and 29 percent of PET bottles and jars were recycled.[11]

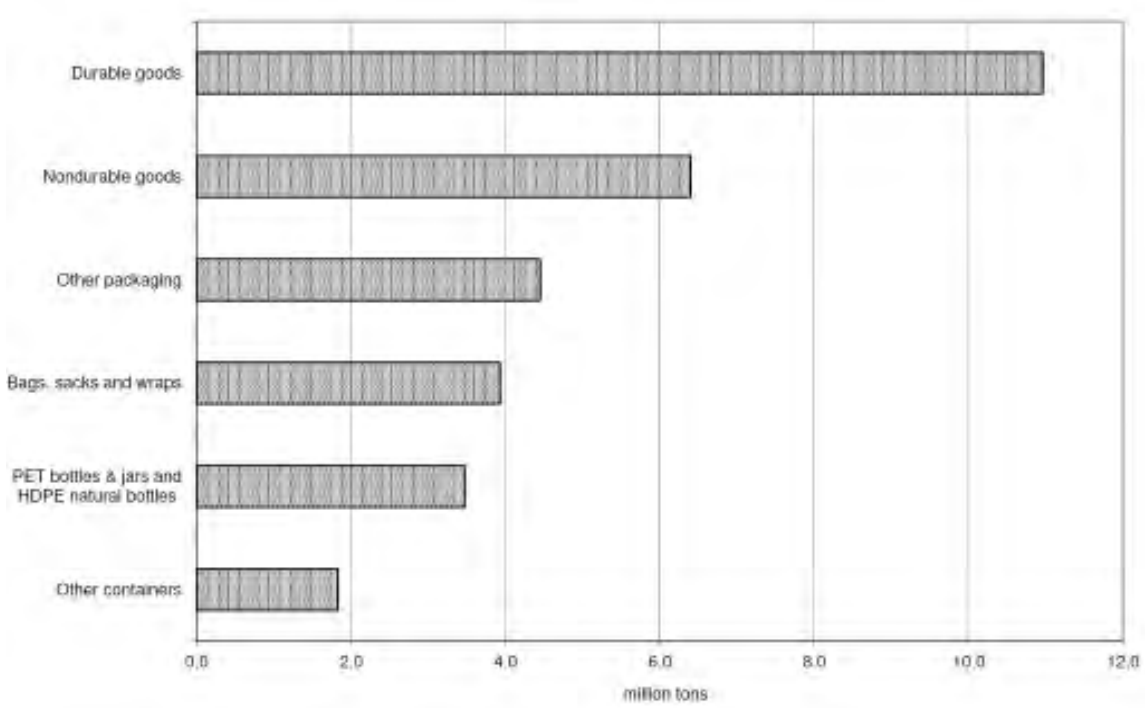
According to the American Chemistry Council (ACC), about 1,800 US businesses handle or reclaim post-consumer plastics. Recycled plastics are usually collected from curbside recycling bins or drop-off sites and then delivered for processing at a material recovery facility (MRF) where the materials are sorted into broad categories (plastics, paper, glass, etc.). The resulting mixed plastics are sorted by plastic type, baled, and sent to a reclaiming facility. At the reclaiming facility, any trash or dirt is sorted out, further sorting of plastic resin types occurs and colors are separated. The plastic is then washed, ground into small flake and passed through a flotation tank that further separates contaminants based on their different densities. The flake is then dried, melted, filtered, and formed into pellet (or "recycled resin"). The pellet is shipped to product manufacturing plants, where it is made into new plastic products.

## 2.2 National Trends in Plastics Recycling

Recent trends in plastic recycling inform the study of future growth opportunities. Plastics make up more than 12 percent of the municipal solid waste stream, a dramatic increase from 1960, when plastics were less than one percent of the waste stream.

**Diverse Uses of Plastic:** Figure 2-1 displays the types and relative amounts of plastic products in the mixed municipal solid waste (MSW) stream.

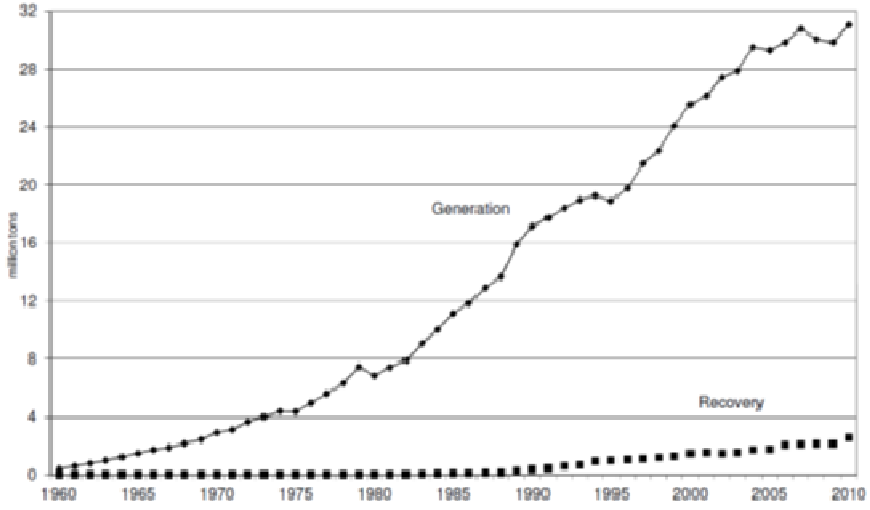
### Figure 2-1
### Plastics Products in MSW, 2010




Source: U.S. EPA (2011) *MSW Generation, Recycling, and Disposal in the United States: Tables and Figures for 2010*

**Waste Growing Faster than Recycling:** Figure 2-2 compares plastic waste generation to plastics recycling. Recycling (recovery) is growing, but plastic waste generation has grown much faster.

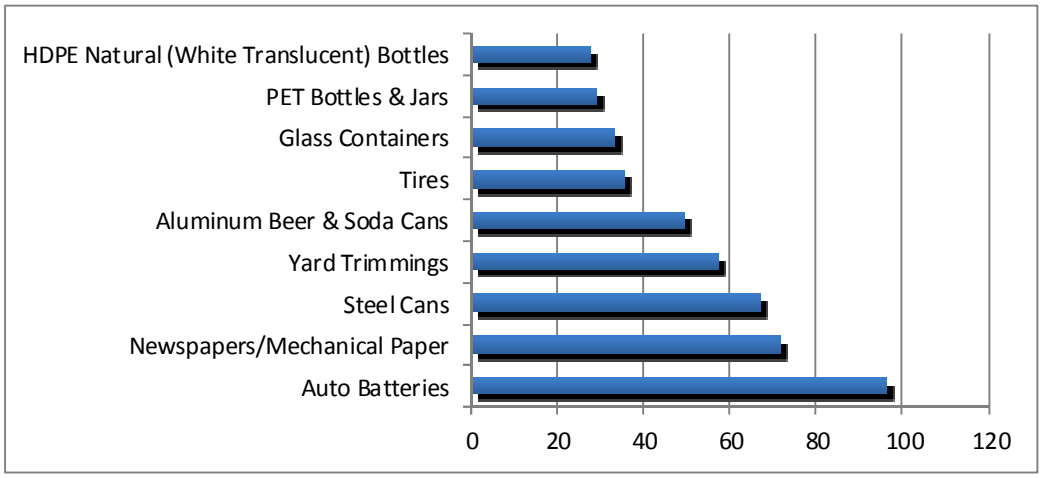
**Figure 2-2**
**Plastics Disposed Of in MSW vs. Recycled, 1960 – 2010**




Source: U.S. EPA (2011) *MSW Generation, Recycling, and Disposal in the United States: Tables and Figures for 2010*

**Plastic Recycling Rates Are Low:** Figure 2-3 displays the national recycling rates of selected products in 2010 showing PET bottles and jars at 29.2 percent and HPDE Natural bottles at 27.5 percent. This is low compared to the recycling rate of newspapers at 71.6 percent near the other end of the spectrum.[12]

## Figure 2-3
## Recycling Rates of Selected Products, 2010




Source: U.S. EPA (2011) *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*

Table 2-1 focuses on the U.S. EPA data collected by Franklin Associates for plastic packaging products over the past two decades showing the growth in tons recovered. Table 2-2 shows that despite the growth in recovered tonnages, recovery rates (in percent) remain modest.

## Table 2-1
## Recycling of Plastic Packaging Products in MSW, 1960 – 2010

(Thousands of Tons)

| Products | Thousands of Tons | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2005 | 2007 | 2008 | 2009 | 2010 |
| Plastic Packaging | | | | | | | | | | |
| PET Bottles and Jars | | | 10 | 140 | 380 | 590 | 700 | 730 | 720 | 780 |
| HDPE Natural Bottles | | | Neg. | 20 | 210 | 230 | 230 | 220 | 220 | 220 |
| Other Containers | Neg. | Neg. | Neg. | 20 | 170 | 140 | 190 | 208 | 290 | 300 |
| Bags and Sacks | | | | | | | | | | |
| Wraps | | | | | | | | | | |
| Subtotal Bags, Sacks, and Wraps | | | Neg. | 60 | 180 | 230 | 380 | 390 | 360 | 450 |
| Other Plastics Packaging | Neg. | Neg. | Neg. | 20 | 90 | 9 | 90 | 110 | 130 | 100 |
| Total Plastics Packaging | Neg. | Neg. | 10 | 260 | 1,030 | 1,280 | 1,590 | 1,730 | 1,720 | 1,850 |

**Recycling of postconsumer wastes; does not include converted/fabrication scrap. Details may not add to totals due to rounding.**

Source: U.S. EPA (2011) *MSW Generation, Recycling, and Disposal in the United States: Tables and Figures for 2010, web page* (December 2011)

## Table 2-2
## Recycling Rate of Plastic Packaging Products in MSW, 1960 – 2010

(Percent of Total Generation for Each Product)

| Products | Thousands of Tons | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1960** | **1970** | **1980** | **1990** | **2000** | **2005** | **2007** | **2008** | **2009** | **2010** |
| Plastic Packaging | | | | | | | | | | |
| PET Bottles and Jars | | | 3.8% | 32.6% | 22.1% | 23.2% | 24.6% | 27.2% | 28.0% | 29.2% |
| HDPE Natural Bottles | | | Neg. | 3.8% | 30.4% | 28.8% | 28.0% | 29.3% | 28.9% | 27.5% |
| Other Containers | Neg. | Neg. | Neg. | 1.4% | 9.8% | 9.9% | 9.9% | 14.7% | 16.6% | 16.4% |
| Bags and Sacks | | | | | | | | | | |
| Wraps | | | | | | | | | | |
| Subtotal Bags, Sacks, and Wraps | | | Neg. | 2.4% | 4.3% | 5.2% | 9.1% | 9.8% | 9.4% | 11.5% |
| Other Plastics Packaging | Neg. | Neg. | Neg. | 1.0% | 3.2% | 2.8% | 2.3% | 3.0% | 3.6% | 2.2% |
| **Total Plastics Packaging** | **Neg.** | **Neg.** | **Neg.** | **3.8%** | **2.9%** | **10.3%** | **11.7%** | **13.3%** | **13.7%** | **13.5%** |

**Recycling of postconsumer wastes; does not include converted/fabrication scrap. Details may not add to totals due to rounding.**

*Source: U.S. EPA (2011) Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Tables and Figures for 2010*, web page (December 2011)

**Significant Differences in Recycling Rates for Certain Plastic Types:** Recent studies have indicated that over 2,100 communities, nationally, collect "all plastic bottles" for recycling, not just PET and HPDE bottles. A growing number of communities are expanding the list of recyclable plastics to include "non-bottle rigid containers."[13] Other communities are going further and expanding their list of recyclable plastics to include "All bulky rigid plastics" and "Film / bags."

For businesses, PE film is the type of plastic with the largest tonnage recycled.[14] This indicates a more mature recycling infrastructure for PE film and, therefore, and because the infrastructure is in place, there are additional opportunities for increasing recycling of PE film by businesses and industry.

For this study, the DNR is focused on recycling growth opportunities of post-consumer plastic rigid containers, bulky rigid plastics and film/plastic bags collected from residents and commercial establishments. Achieving increased recycling of these materials will depend, in part, on past and planned national and global investments in plastics recycling infrastructure. For example, PET and HDPE bottles have the highest recycling rates because these types of plastics have a relatively high value and represent the majority of rigid, post-consumer plastics recycled. PET and HDPE bottles comprise over 96.5 percent of U.S. plastic bottles produced and 99 percent of bottles recycled.[15]

Other types of plastics such as non-PET/non- HDPE bottles, non-bottle rigid containers, bulky rigids and plastic bags are being recycled in more and more community programs throughout the U.S., but the actual level of recycling is limited by the challenge of reaching a critical mass of readily recognizable plastic materials for cost-effective collection and processing.
For example, bottles made from non-PET/non-HDPE resins (e.g., PVC, LDPE, PP, PS and Other, also known as RIC types #3 through #7) make up only 3.5% of the plastic bottle market.[16]

The next largest market share of other, minority resin types used to make bottles are:

- PP = 2.2 percent
- PVC = 0.8 percent.[17]

Table 2-3 displays post-consumer plastic bottle recycling in 2009 and 2010 as reported by American Chemistry Council (ACC) and Association of Postconsumer Plastics Recyclers (APR) in 2011. The "recycling rates" are based on surveys of recycled plastic reclaimers and industry data about the amount of specific virgin resins produced to make plastic bottles (except for "Other" resin type, RIC code #7). The highest recycling rate is for HDPE - colored bottles at 32.7 percent, followed by PET at 29.1 percent and then HDPE - natural bottles. These three major recycled resins have consistently constituted the vast majority of recycled bottles.

Table 2-3 documents the increase in PP bottle recycling from 14.1 percent in 2009 to 18.3 percent in 2010. As a secondary bottle resin commodity, this rising recycling rate trend is expected to continue in the future even though the amounts will remain relatively small compared to the major resins. Only 35.4 million pounds of PP were recycled in 2010 compared to 2,541 million pounds of PET and HDPE bottles combined.

## Table 2-3
## Post-Consumer Plastic Bottles Recycled in 2009 and 2010[1]

(In Millions of Pounds per Year)

| | Calendar Year 2009 | | | Calendar Year 2010 | | |
|---|---|---|---|---|---|---|
| **Plastic Bottle Type** | **Plastic Recycled[2]** | **Resin Recycled[3,4]** | **Recycling Rate** | **Plastic Recycled[2]** | **Resin Recycled[3,4]** | **Recycling Rate** |
| PET[4] | 1,444 | 5,149 | 28.0% | 1557 | 5,350 | 29.1% |
| HDPE - natural | 457.0 | 1,613 | 28.3% | 434.1 | 1,604 | 27.1% |
| HDPE - colored | 524.6 | 1,752 | 29.9% | 550.0 | 1,682 | 32.7% |
| **Total HDPE Bottles** | **981.6** | **3,365** | **29.2%** | **984.1** | **3,286** | **29.9%** |
| PVC[5] | 2.0 | 66 | 3.0% | 1.4 | 68 | 2.0% |
| LDPE[5] | 1.4 | 72 | 2.0% | 1.0 | 56 | 1.9% |
| PP[6] | 27.0 | 192 | 14.1% | 35.4 | 193 | 18.3% |
| Other[7] | 1.0 | | | 3.4 | | |
| **Total Bottles** | **2,456** | **8,844** | **27.8%** | **2,579** | **8,953** | **28.8%** |

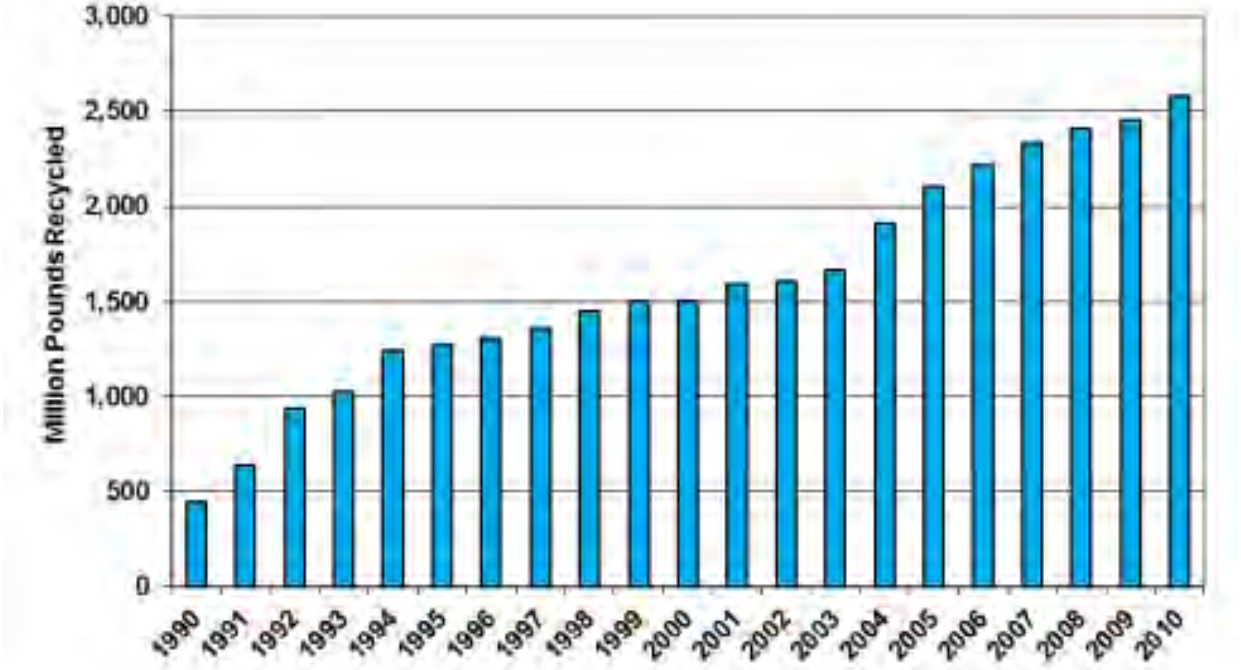
Source: APR and ACC - *2010 United States National Postconsumer Plastics Bottle Recycling Report*

1. These data provide a snapshot of plastic bottle recycling collection trends from the national perspective. The data are particularly useful in identifying national trends and highlighting changes that have occurred from year to year, and may be a useful tool for planning purposes. While national data may be useful as a comparison with local waste characterization and recycling data, significant differences will exist from locality to locality and from state to state. If communities or states are making decisions where precise knowledge of the amount, composition and disposition of MSW is crucial. For example, where a solid waste management facility is being designed, or for local or state regulatory enforcement, etc., then local characterization of the quantities of individual components generated, recycled and disposed is essential.
2. Data are based on surveys performed by Moore Recycling Associates, Inc. and include bale composition data provided by Moore Recycling Associates, Inc. and others.
3. Based on data provided by the American Chemistry Council's Plastics Industry Producers Statistics Group. HDPE resin sales include both the virgin and recycled plastic pounds used to produce new bottles. Imports are not included.
4. Source: 2010 Report of Post-Consumer PET Container Recycling Activity, National Association of PET Container Resources, Sonoma, California
5. The majority of PVC and LDPE recycled were as part of commingled bottle and container bales.
6. About 3/4 of PP bottles were deliberately recycled as PP bottles, about 1/7 were included in commingled and mixed plastic bales, and about 1/6 were included with HDPE – colored.
7. Limited data for bottles of other resins are shown. Material sold as part of mixed export bale. No denominator values are available.

The amounts and types of post-consumer plastic bottle recycling have increased steadily over the past two decades. Figure 2-4 indicates the steady growth of plastic bottle recycling to the 2010 level of 2,579 million pounds. This growth trend in recycling is expected to continue into the future despite the sluggish economy and the light-weighting and downsizing of plastic bottles.[18]

## Figure 2-4
## Growth in Post-Consumer Plastic Bottle Recycling

(Millions of Pounds Recycled per Year)




Source: APR and ACC - *2010 United States National Postconsumer Plastics Bottle Recycling Report*

### 2.2.1 Public Access to Plastics Recycling: The ACC-Sponsored National Reach Study

The ACC funds a periodic study conducted by Moore Recycling Associates to determine the types of rigid plastics that are collected in municipal curbside or drop-off recycling programs in the U.S. The purpose of the project conducted in 2011, *Plastic Recycling Collection: National Reach Study* (May 2011), was to document the percentage of the population that has access to recycling of various types of plastics. A similar study was conducted in 2008.

Rigid plastic includes plastic packaging such as bottles, tubs, cups, containers and trays; it also includes non-packaging products such as storage boxes, toys, and bins.

Table 2-4 lists the type of plastics collection program and the corresponding definition of the types of plastics accepted in that program.

## Table 2-4
## *National Reach Study*: Plastic Collection Program Definitions

| Plastics Collection Program | Definition |
|---|---|
| All Plastic | ♦ All bottles and caps<br>♦ All non-bottle rigid containers (includes cups, trays, boxes, clamshells, tubs, pots, deli containers, carton, blister)<br>♦ All bulky rigid plastic (includes carts, crates, buckets, baskets, toys, lawn furniture)<br>♦ Includes film and EPS |
| All Rigid Plastic | ♦ All bottles and caps<br>♦ All non-bottle rigid containers (includes cups, trays, boxes, clamshells, tubs, pots, deli containers, carton, blister)<br>♦ All bulky rigid plastic (includes carts, crates, buckets, baskets, toys, lawn furniture) |
| All Bottles and Non-Bottle Rigid Containers | ♦ All bottles and caps,<br>♦ All non-bottle rigid containers (includes cups, trays, boxes, clamshells, tubs, pots, deli containers, carton, blister) |
| All Bottles and Non-Bottle Rigid Containers & Specific Plastics | ♦ All bottles and caps,<br>♦ All non-bottle rigid containers (includes cups, trays, boxes, clamshells, tubs, pots, deli containers, carton, blister) May also include film and/or EPS |
| All Bottles | ♦ All bottles with a narrow neck or screw top and their caps |
| All Bottles & Specific Plastics | ♦ All bottles with narrow neck or screw top and their caps, plus specific plastic types<br>♦ May also include film and/or EPS |
| CRV Only | ♦ California Redemption Value (CRV) plastic beverage containers |
| CRV Bottles & Specific Plastics | ♦ CRV plastic beverage containers, plus specific plastic types<br>♦ May also include film, EPS, and/or other non-CRV plastic) |
| PET & HDPE Bottles Only | ♦ PET & HDPE bottles and caps |
| PET & HDPE Bottles & Specific Plastics | ♦ PET & HDPE bottles and caps, plus specific plastic types<br>♦ May also include film, EPS, and/or other bottles |
| Other Specific Plastics | ♦ Other specific plastics outside of other categories |

Source: Moore Recycling Associates, Inc., *Plastic Recycling Collection: National Reach Study* (May 2011)

Table 2-5 displays the summary findings of the 2011 *National Reach Study* concluding that:

- At least 94 percent of the U.S. population has access to PET and HDPE bottle and cap recycling.

- About 40 percent has access to recycling programs that collect, at least, all plastic bottles and caps, and all non-bottle rigid containers.

This *National Reach Study* did not include collection of film & bags as most of these materials from consumers are collected through over 15,000 retail drop-off programs located across the U.S. The film and bag recycling "reach" (i.e., level of recycling collection service available) is documented in a separate report entitled "*Plastic Film and Bag Recycling Collection: National Reach Study*" released April 2012.

Because the *National Reach Study* did not separately survey for deposit programs, it is likely that the PET bottle rate of service is higher than indicated in this study.

**Table 2-5**
***National Reach Study*: Summary Findings**

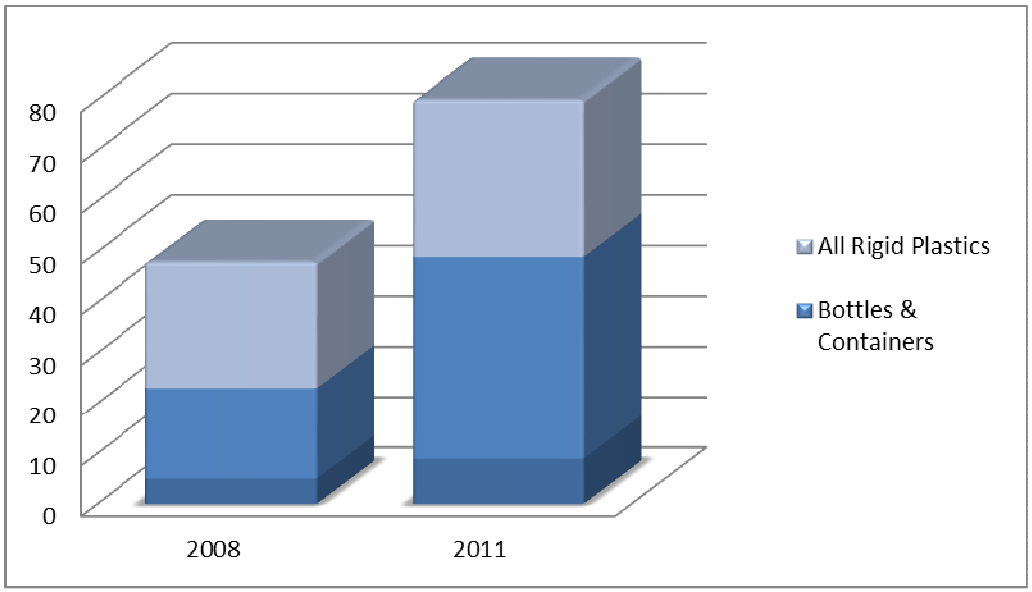
| Plastic Collection Program | Percentage of US Population with Recycling Access |
|---|---|
| All Plastic | 2.4% |
| All Rigid Plastic | 13.0% |
| All Bottles & Non-Bottle Rigid Containers & Specific Plastics | 3.0% |
| All Bottles & Non-Bottle Rigid Containers | 21.2% |
| All Bottles & Specific Plastics | 1.9% |
| All Bottles Only | 12.5% |
| PET & HDPE Bottles & Specific Plastics | 12.9% |
| PET & HDPE Bottles Only | 26.8% |
| All CRV Bottles & Specific Plastics | 0.1% |
| All CRV Bottles Only | 0.2% |
| Other Specific Plastics | 0.6% |
| No Plastic Program | 5.4% |


Source: Moore Recycling Associates, Inc., *Plastic Recycling Collection: National Reach Study* (May 2011)

The *National Reach Study* found that there has been substantial growth in the collection of non-bottle rigid plastics. In November of 2008, Moore Recycling Associates surveyed the 100 most populous cities, nationally, to determine what types of plastic they collected for recycling. In 2008 only 29 cities had access to non-bottle rigid plastic recycling compared to 59 in 2011. While all the 100 most populous cities collected PET and HDPE Bottles in 2008, only 38 percent had access beyond PET and HDPE bottles compared to 71 percent in 2011.

Figure 2-5 displays these results from the 2011 *National Reach Study*.

**Figure 2-5**
***National Reach Study*:**
**100 Most Populous Cities: Plastic Collection Programs**




Source: Moore Recycling Associates, Inc., *Plastic Recycling Collection: National Reach Study* (May 2011)

**Lack of Recycling Access Does Not Explain Lackluster Recycling Rates:** Moore Recycling notes that the results show there is widespread access to plastic bottle recycling, yet the recycling rate for PET and HDPE bottles is still under 30 percent. This means that the public, communities, institutions and other commercial establishments are not consistently taking advantage of the recycling services available. Also, a portion of the recyclable plastic material is being lost in the collection and processing systems.

There is much work to be done across the country in providing the public with clear and concise information when it comes to learning about recycling programs.[19]

Moore Recycling believes there is a pressing need to develop a universal language for purposes of public education to describe items acceptable for plastic recycling. Many city and county outreach materials leave too much room for personal interpretation, and much of it is confusing. Creating standardized public education outreach terminology, while still providing local control about collection/processing design, would be invaluable and reduce the confusion surrounding communications to the general public about plastic recycling collection. Best practices guidelines for residential plastics recycling public education systems suggest the use of color photos of acceptable containers, shorter more concise descriptions of the types of targeted plastics, and a companion list of types of plastics NOT acceptable. This would help increase the capture rate in those communities that do collect plastic beyond bottles.[20]

## 2.3 Declining Supplies of Recyclable Plastic Bottles

Nationally, plastics processors and end markets around the country have been experiencing declines in their supplies of traditional recyclable plastic bottles, primarily HDPE. This trend is due to a number of factors, including:

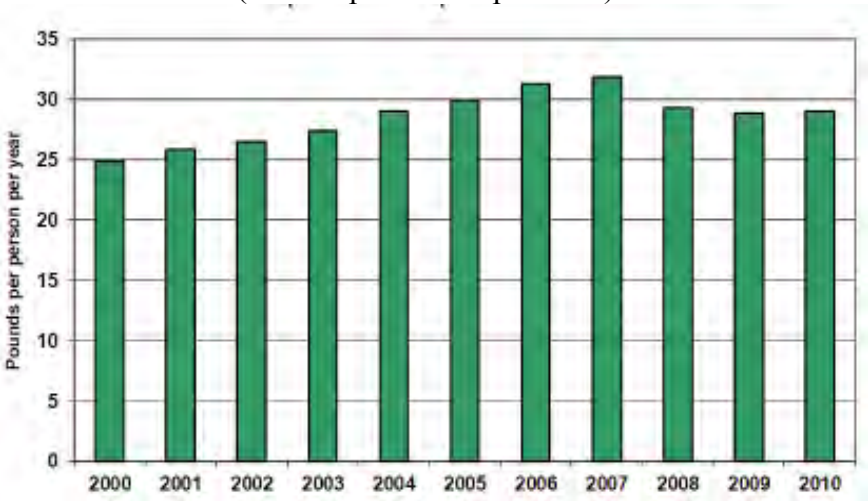
- Light-weighting of plastic bottles.
- Downsizing of bottles due to use of concentrates.
- Reduced consumption.
- Increased competition by other end users domestically and from foreign markets.
- Reduced effectiveness of community recycling programs in collecting and processing PET and HDPE bottles.

Plastic bottle light-weighting and downsizing is a continuing trend in the plastic packaging industry. Light-weighting meets economic and sustainability goals and is a relentless force in plastic bottle making. But while lighter bottles are more economically sustainable, recycling success is measured by weight. When fewer plastic tons are generated and therefore less material is available for recycling, recycling as a percentage of total waste weights decreases, even when more bottles are recycled. PET container manufacturers continue to make PET bottles lighter – up to 30 percent lighter over the last 10 years.[21] Between 2000 and 2008, the weight of 16.9-ounce, single-serve PET water bottles dropped by nearly 33 percent. The average PET bottled water container weighed about 19 grams in 2000; by 2008, the average amount of PET in each bottle declined to about 13 grams.[22] Many HDPE bottle applications are using product concentrates, which means an increasing number of smaller bottles and fewer bottles made for the total number of uses, such as laundry loads.

The United States per capita consumption of bottle resins, virgin and recycled, peaked in 2007 and has dropped for the past three years in part due to this light-weighting trend. Figure 2-6 displays the 11-year trend in bottle consumption.[23]

**Figure 2-6**
**Per Capita Consumption of Plastic Bottles**

(Pounds per Person per Year)




Source: APR and ACC - 2010 United States National Postconsumer Plastics Bottle Recycling Report

Plastic markets in Asia have been among the strongest growth sectors in plastics recycling over the past 20 years. Plastic processors, reclaimers and end users have emerged in countries like China creating a significant export demand from the U.S. for residential postconsumer plastic. While this demand has improved prices for recovered plastic, it has also reduced supply to U.S. manufacturers and has created dependency on overseas markets that may not be sustainable.

Community recycling programs are generally trying to make continuous improvements in recycling education, convenience and collection efficiencies. However, some communities do not have the resources to make such improvements and recycling rates can stagnate or even fall off. As population grows, more material is generated but recycling capture rates often do not keep up with this growth.

## 2.4 Recycling Beyond PET and HDPE Bottles

Although the high usage rates and modest recovery rates indicate PET and HDPE bottles offer the best opportunities for increasing volumes and value of recovered plastic, there are several national efforts underway to collect the other types of plastics that are part of this study, including:

- Non-PET/Non-HDPE bottles made from PVC, LDPE, PP, PS and "Other" resin types.
- Non bottle rigid containers of all resin types (e.g., cups, trays, boxes, clam-shells, tubs, lids, pots, deli containers, carton, blister packaging).
- Plastic film (e.g., bags and wrap).
- Bulky rigid plastics (e.g., carts, crates, buckets, baskets, toys, lawn furniture).

This sub-section describes national programs to improve domestic recycling beyond PET and HDPE bottles. The common catch phrase in the recycling industry is to "expand plastic recycling to resin types "#3 through #7." This informal short-hand, while convenient, incorrectly defines the scope of these additional efforts to expand recycling beyond PET and HDPE bottles. For example, non-bottle PET and HDPE containers such as thermoform packaging, tubs, bowls, etc., are unintentionally excluded when the phrase "#3 through #7" is used to describe these other types of plastics.

### 2.4.1 APR's Rigid Plastics Recycling Program

In 2008 APR created the Rigid Plastics Recycling Program to increase the recycling rate of rigid plastics beyond PET and HDPE bottles. A national approach to rigid plastic recycling, improvement in the collection infrastructure for rigid plastics, and the increased availability of post-consumer PP recycled resin are some of the long term goals of the program.[24]

Bale quality from MRFs or processors can be a significant problem for end markets or manufacturers, especially for the mixed rigid plastics (i.e., non-PET/non-HDPE and non-bottle grades). Markets often have difficulty absorbing the added costs of sorting and residual disposal if too many contaminants and prohibitives are included in mixed rigid bales.

Moore Recycling and the APR Rigid Plastic Recycling Committee conducted a recyclable plastics composition study to better understand the factors affecting bale quality from MRFs. They identified seven distinct types of mixed resin bales being produced in North America that contain non-bottle rigid plastic:

1. All rigids.
2. Bottles and containers.
3. Pre-picked rigids (i.e., that have been positively sorted).
4. Small containers.
5. Tubs and lids.
6. Bulky rigids.
7. Olefin bale.

Using these seven bale types as a base, twenty-nine bales were sorted from 24 MRFs located on the West Coast, Eastern States, Midwest and Canada.[25] The study showed that "household container" bales and "bulky rigid" bales have the lowest contamination levels and recover the most plastic. The study concluded that the greatest impact on bale quality and composition of recovered plastics is MRF practices, such as how they sort the plastics (categories, technology, positive or negative) and how well they sort the plastics (capacity vs. flow-through, management priorities). Secondary impacts on bale quality include regional demographics and other program-specific circumstances (e.g., public education, collection methods).

One conclusion from these types of studies is that quality of material needs to be emphasized at each step down the recyclables supply chain, all the way to the municipal collection programs. One of the very basic messages to participating residents and businesses that should also be emphasized is: "Rinse your plastic containers before putting them in your recycling bin."

APR is also promoting domestic markets for "tubs & lids".[26] APR has published lists of domestic markets for "Tubs & Lids" (Figure 2-7) indicating that this opportunity is growing.

## Figure 2-7
## Locations of APR Member Markets for "Tubs & Lids"

Source: *APR Rigid Plastic Recycling Program* (2011)

### 2.4.2 ACC Plastic Bag Recycling Program

According to the latest report prepared by Moore Recycling for ACC[27], recycling of postconsumer film (which includes plastic bags and product wrap) grew to an estimated 971.8 million pounds in 2010 over the past few years. The increase for retail collected film and bags is likely due to years of education and support for recycling as more consumers take advantage of store collection programs and more businesses understand the economic benefits of film recycling. Growth in film plastic recycling has been steady, particularly in retail environments with well-established programs.

Despite this recent growth in recovered tonnage of postconsumer film, the recycling rate remains relatively low at around 10 percent. Large volumes of readily recyclable film are still being missed because the collection infrastructure is not yet comprehensive enough to handle the small to medium generators. With more haulers, wholesale distributors, and business-to-business programs accepting film, growth should continue.[28] The Plastics Division of the ACC provides resources to communities, businesses and consumers to assist with increasing awareness and education of the recycling of plastic bags and film. A separate project of ACC, the Flexible Film Recycling Group (FFRG), is promoting awareness and providing technical assistance to help increase recovery of polyethylene (PE) film.[29] FFRG is one of the primary sponsors of the program *"PlasticBagRecycling.org"*.[30]

End-use manufacturing applications for recyclable film and recycled resin derived from film continue to grow. Composite lumber manufacturers continue to lead the domestic film market, but there was continued growth in the amount of material going into domestic non-lumber end-use markets, such as film and sheet manufacturing.

Recycling levels increased from 2009 to 2010 in all other large categories of film.[31] The Moore Recycling survey breaks the categories of film into segments such as:

- Bags and film collected from retail drop-off bins ("mixed film" comprised of mixed color, clean PE film including grocery bags).
- Curbside film (mixed film as processed at MRFs).
- Commercial film (clear, clean PE film including stretch wrap and poly bags).
- Agricultural film (both "dirty" that has come in contact with the soil and "clean" that has not come in contact with the soil).

Recyclable film enters the market in various categories, and typically includes a combination of baled HDPE, LDPE, and LLDPE resins. Stretch film made from LLDPE, collected as commercial film and as a part of mixed film, represents a significant majority of the post-consumer film recovered. Curbside-collected bags represent a relatively small amount. Plastic bags often are commingled with stretch film wrap for efficient collection at retail locations. Processors estimate bags make up 40 to 55 percent of the commingled bales purchased from retail programs.[32]

As the film recycling industry matures, film grades are becoming more clearly defined, but grades of material are still extremely inconsistent, particularly with exporters. Most retailers that offer bag recycling to customers do so voluntarily. Many large chains have recovered film and bag material for over two decades. The incentives to these grocery store companies include: revenue from the recycled material, avoided disposal costs, and the goodwill they extend to their

communities. Large retailers have efficient reverse-transportation logistics. As their trucks return to distribution centers, they back haul recyclable film, cardboard and other materials. Finally, the voluntary recycling of grocery bags is a political strategy to help defend against more onerous mandates or bans.

Commingling film (residential or commercial) in a single-stream program for processing at a MRF often produces a heavily contaminated and, therefore, low value material stream. Handling of film commingled with other residential curbside recyclables reduces the efficiency of screens and other machines needed for the mechanical sorting of other materials. Film often wraps around the screens, clogging equipment thus requiring significantly more maintenance down time. Manual sorting of bags and other film on MRF sort lines is a major problem given that it reduces the efficiency of workers trying to sort rigid containers. Film fragments or bags that float in the air due to their lightweight nature also reduce the effectiveness of automatic plastic detection machines by interfering with the infrared or X-ray readers. Commingled film is costly to process, both at the MRF and by reclaimers since it requires significantly more processing.

Industry quality standards are developing for recyclable plastic film but have a long way to go. The number of grades in the marketplace is expanding and terminology is becoming more consistent. Film manufacturers play a role in designing products that are recyclable or do not create contamination problems within the recycling stream. While design-for-recycling guidelines are established for bottles[33], such guidelines for the film recycling industry are still under development by APR.

In addition to rigid plastics, and as noted above, Moore Recycling conducts a national survey of communities to determine the percentage of the U.S. population that has access to plastic retail bags and plastic film recycling.[34] The results show that 91% to 93% of the U.S. population has access to plastic bag recycling and 72% to 74% also have access to plastic film recycling via curbside collection or because they live within 10 miles of a drop-off facility. Moore Recycling identified 15,023 drop-off locations, nationally that accept film for recycling. The majority of locations, as previously identified, are retail drop-off.[35]

The Moore Recycling study found that there is not enough education regarding plastic bag recycling and even less knowledge about film recycling beyond bags, even among those locations that accept the material. People want to do the right thing, but they don't know what the right thing is.[36]

The interest in plastic film and bag recycling is becoming much more heightened because of the increasing number of local bans or recycling requirements on the plastics grocery bags. Plastic bag bans are now in place in over 80 U.S. communities.[37] In other cases, such as the State of New York, retailers are required to provide recycling opportunities for plastic bags if their stores use or sell such bags.[38]

## 2.5 Automated Plastic Sorting Technology

The difficulty of accurately and efficiently sorting plastic at MRFs has traditionally impeded recovery of these materials, and the growth in single-stream collection systems has made the challenge more acute. In recent years, automated sorting technology has offered a solution to this problem. Recently ACC commissioned a second edition report on the topic of automated sorting technology. The report, *Demingling the Mix: An Assessment of Commercially Available*

*Automated Sorting Technology,* was prepared and published in January 2011 by 4R Sustainability, Inc. for ACC[39]. The following summary is derived directly from this 4R Sustainability report.

The technologies included in the 4R study covered mechanical and optical separation technologies, hand-held identification devices, and technologies that separate and identify resins and colors. This report considered equipment that was able to sort either whole units, such as bottles and non-bottle rigid packaging, and flake or size reduced material (to handle material such as e-plastics, or plastics from recovered electronics). The 4R study did not consider technologies that use electrostatic or density separation methods.

In total, the 4R study identified 19 manufacturers of automated sorting equipment offering 52 different systems. Of those 52 systems, 26 systems were for sorting whole plastic containers and 26 systems handled flake, pellets or shredded plastics. In terms of hand-held identification devices, six manufacturers were identified that offered this type of portable equipment.

The trend towards single-stream recyclables collection and processing is clear. As of 2008, about 120 of the 570 MRFs in the U.S. were receiving single-stream material. For many years, MRFs have been employing automated sorting systems to more efficiently separate the more valuable HDPE and PET containers from the remaining plastics and other materials for several years. When installed in a MRF, automated sorting equipment is most commonly used to generate sorted streams of PET and mixed HDPE, or sorted HDPE – natural vs. HDPE – colored. By 2006, 50 MRFs in the U.S. were using automated sorting technology to separate plastics.[40] That number has likely grown, and future demand for sorting equipment is expected to be strong from MRFs in coming years.

In addition, optical and mechanical sorting technology can be highly accurate and therefore significantly improve bale quality. Manual sorting often yields higher bale contamination, particularly in the event that resins are present in the stream that visually can be easily mistaken for another resin. This is particularly the case for PET, PLA and PVC bottles, all of which can easily be mistaken for one another by the human eye.

Two primary forms of technology are employed to sort plastics by resin: spectroscopy and x-ray. Equipment that uses spectroscopy emits light and each type of plastic reflects that light with a unique signature, or wavelength. X-ray machines look at the plastic on an elemental level. These units include either traditional x-ray or x-ray fluorescence (XRF). X-ray technology is particularly useful in detecting elements such as chloride (PVC) and bromine additives (such as brominated flame retardants) which are often found in plastics used in electronics. While PVC can be identified by spectroscopy, additives such as bromine cannot. In either case, after the automatic sensor reads that resin signature, a processing unit decides how the plastic should be sorted.

Two primary technologies are employed for color sorting. These consist of vision technology which uses cameras, such as CCD linear cameras, and spectroscopy, including visible range spectrometer (VIS). Many of these technologies can see any shade that is seen by the human eye and can differentiate between slight differences in clear PET, such as blue versus green.

Pricing for equipment varies based on capacity and features. Buyers can expect to pay in the range of $100,000 to $300,000 for a system that sorts whole containers. Flake sorting can be more expensive with the range averaging $150,000 to $350,000. Flake units can cost upwards of $600,000 depending on the features and manufacturer. This is the estimated cost of buying a piece of equipment from a manufacturer and does not include shipping, installation, employee training, operating costs or MRF production downtime during installation and start-up.

In terms of lifespan, most of these automated sorting units are built to last. Manufacturer warranties typically extend into the 10 to 15 year range, however, some manufacturers report systems remaining in operation 17 or more years after initial installation. Much of the lifespan of a unit depends on adherence to routine and regular maintenance and cleaning. Obsolescence is an investment risk which can force a unit into early retirement. Obsolescence seems to be less of an issue for MRFs, which are often seeking to maximize the value of PET and HDPE bales, and more of an issue for reclaimers, who desire to remove contaminants down to the lowest levels. One way system manufacturers are addressing the threat of obsolescence is to provide customers with regular software updates that recognize new or unfamiliar packaging that may be introduced into the marketplace and end up in the plastic recycling stream.

The 4R report predicted the demand for automated plastics sorting technology will continue to grow. 4R identified several trends driving the need for and application of automated plastics sorting technologies, including:

- Expansion of plastics recycling beyond PET and HDPE will continue.
- The significant conversion trend to single-stream recyclables collection/processing and other commingled systems will continue.
- Multi-layer bottles and barriers, and new types of labels, will continue to present challenges for automated sorting equipment. New sorting technologies may emerge, but in the meantime, PVC and PET-G labels also continue to be a problem for sorting equipment. These multi-resin bottle designs cause miss-identification of those PET bottles, resulting in the loss of PET in the sortation process.
- Adoption of automated sorting equipment will continue to grow in export markets (e.g., China, India,).
- New companies will emerge offering more advanced technologies for flake and other size-reduced particle sorting.

## 2.6 Container Deposits

Container deposit legislation refers to any law that requires collection of a monetary deposit on soft-drink, juice, milk, water, alcoholic-beverage, or other beverage containers at the point of sale. When the container is returned to an authorized redemption center, or to the original seller in some jurisdictions, the deposit is partly or fully refunded to the customer (presumed to be the original purchaser).[41]

Governments may pass container deposit legislation for several reasons, including to:

- Encourage recycling and complement existing curbside recycling programs
- Help reduce beverage container litter along highways, in lakes and rivers, and on other public or private properties. A nominal deposit provides an economic incentive to pick-up eligible deposit containers.

- Extend the usable lifetime of taxpayer-supported community or regional landfills.
- Protect children and animals by reducing the likelihood of glass lacerations.

Deposits that are not redeemed are often retained by the governing agency to fund environmental programs. Sometimes unredeemed deposits are used to cover the added net costs of handling and processing returned containers and/or other system costs (e.g., administration, retraining, education, and enforcement of the program). In some systems, unredeemed deposits are retained by beverage distributors to offset their costs.

The Container Recycling Institute (CRI) is a non-profit organization that advocates for container deposit systems and compiles research, data and campaign tools. The CRI web page itemizes the states, Canadian provinces and other countries that have container deposit systems.[42]

Eleven states currently have container deposits:

- California
- Connecticut
- Hawaii
- Iowa
- Maine
- Massachusetts
- Michigan
- New York
- Oregon
- Vermont

Figure 2-8 shows a map of states with container deposit laws. (See Appendix 2-A for a list of deposit states and the details of each state system).[43]

**Figure 2-8**
**Map of States with Container Deposit Laws**

Source: CRI *Container Deposit Legislation: Past, Present, Future* (2009)

Thirteen Canadian provinces or territories also have container deposit laws. (See Appendix 2-B for a list of Canadian provinces with deposits and the details of each provincial system):[44]

- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland
- Northwest Territories
- Nova Scotia
- Nanavut
- Ontario
- Prince Edward Island
- Quebec
- Saskatchewan
- Yukon Territory

Deposits in Canada range from 5¢ to 40¢ per unit.

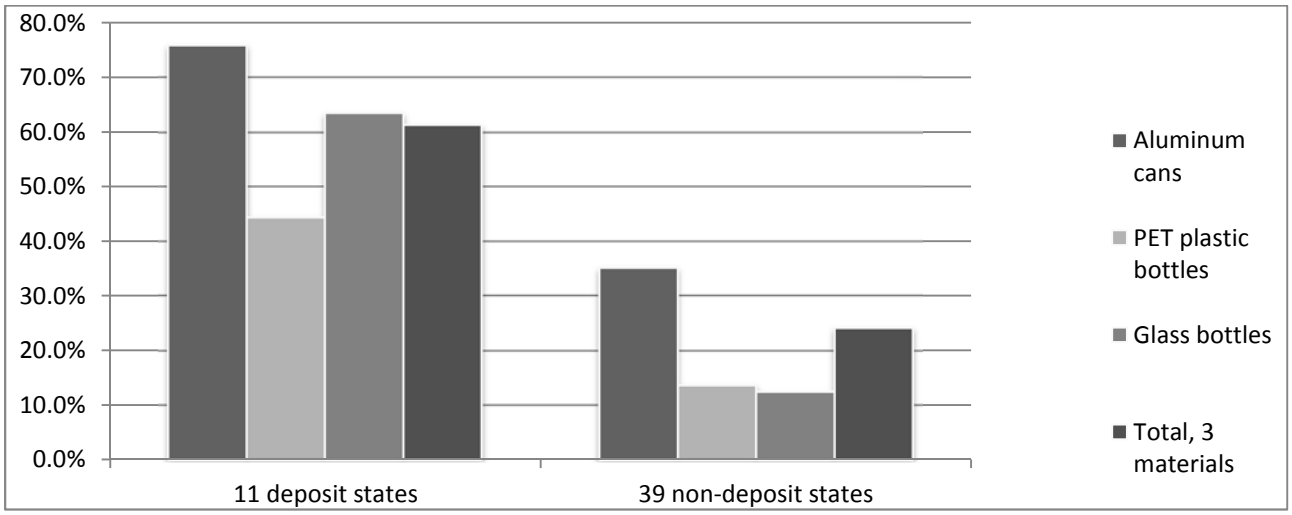
Twenty-one other countries also have various container deposit systems, including[45]

- Australia
- Austria
- Barbados
- Belgium
- Croatia
- Denmark
- Estonia
- Fiji
- Finland
- Guam
- Iceland
- Israel
- Kiribati
- Micronesia
- Netherlands
- Norway
- Palau
- Sweden
- Switzerland
- Turks and Caicos
- Netherlands

### 2.6.1 Recycling Effectiveness

CRI reports that the 11 (Delaware also had a deposit system until 2010) container deposit states have significantly higher recycling rates for deposit materials compared to the 39 states without a deposit program. Figure 2-9 displays CRI's data showing this difference. Eligible PET bottles, which have the lowest recycling rates of the deposit items compared to aluminum and glass beverage containers, still have a much higher recycling rate in deposit states (about 45 percent) compared to non-deposit states (about12 percent).[46] CRI also reports similar differences in recycling rates for eligible beverage containers in other countries with deposit systems.

**Figure 2-9**
**Beverage Container Recycling Rates for**
**Container Deposit States vs. Non-Container Deposit States**




Source: CRI *Container Deposit Legislation: Past, Present, Future* (2009)

A 2002 report prepared for the Multi-Stakeholder Recovery Project of Businesses and Environmentalists Allied for Recycling (BEAR), titled "Understanding Beverage Container Recycling: A Value Chain Assessment"[47] found that a combination of recycling methods in deposit states (deposit redemptions plus municipal curbside & drop-off collections) results in beverage container recycling rates more than two and a half times higher than in non-deposit states. The deposit states recycled 490 containers per capita per year, at a net cost of 0.53¢ per unit. The 40 non-deposit states, which relied solely on curbside programs and drop-off centers, recycled 191 containers per capita per year at a net cost of 1.25¢ per unit.

### 2.6.2 Policy Debates

Efforts to pass container deposit legislation, or efforts to repeal the laws in states with deposits, are nearly always politically controversial. The U.S. beverage industry --- including both the bottlers of water, soda, beer, and the corporate owners of grocery stores and convenience stores --- typically has lobbied against the introduction of both new and amended beverage container deposit legislation. The beverage industry claims that deposit systems cost more than comprehensive recycling or litter control programs while accomplishing the same goals, and that they impose a hidden, regressive tax on consumers in the form of higher prices. They further note that deposit systems remove valuable material from the curbside recycling system, diverting a significant revenue stream from more comprehensive recycling programs. The beverage industry also points out that deposit systems only target a small part of the waste stream and thus are not by themselves a comprehensive solution to start increasing recycling rates. Deposit law proponents counter that deposits are effective at recovering material and maintaining high quality, that there is little evidence that they drive price increases for beverages, that they are compatible with curbside recycling, and that there are many ways to design deposit systems to avoid the problems opponents claim. They also note that materials collected through deposit systems are less prone to contamination and may attract a higher price in the market.

Several existing state deposit programs retain a share of unredeemed deposit revenues. These funds are used to help finance improvements in community curbside and drop-off programs. Many of the more recent container deposit proposals try to integrate the container deposit redemptions with municipal curbside and drop-off collections, together with their MRFs. This "integration" objective may be one of the most critical design criteria to enhance the cost-effectiveness of any new deposit system by managing double handling of commodities (deposit and non-deposit containers) and mitigating the loss of revenue to municipal programs.

As recovered material supply shortages increase, several material–specific trade associations have shown greater support for deposit legislation as an effective means to increase recycling (e.g., aluminum, glass, PET).[48] APR members voted in May 2006 to support the expansion of existing bottle bills and oppose any efforts to repeal them. NAPCOR released a more recent position statement in December 2011 that states more explicitly that "NAPCOR is opposed to the repeal of existing PET supply generating initiatives, including deposit legislation, *unless* they are replaced by initiatives that are equally effective, immediate and sustainable".[49]

In November 2008 the 80-member Aluminum Association released a press statement announcing a new 75% can-recycling goal. The Association acknowledged, for the first time in its history, that container deposits will be among the various tools it will consider as it works with state and local governments to reach that goal. "Container deposits are a proven, sustainable method of capturing beverage cans," said the release. "States that have deposit programs have the highest can recycling rates, on average at 74% or higher, while the recycling rate in non-deposit states is around 38%."
In December 2008, the 44-member Glass Packaging Institute announced that it would "accelerate support of legislative and regulatory measures," including container deposits, in order to achieve a new goal of 50-percent recycled content in glass containers by 2013.

## 2.7 Reclamation Capacity and End Use Manufacturing Applications

Markets for some recycled plastic resins, such as PET and HDPE, are stable and even expanding in the United States. Currently, the US has the collection and processing capacity to recycle plastics at a greater rate. In particular, PET reclamation has seen significant growth in the U.S.[50] The capacity to process post-consumer plastics and the market demand for recovered plastic resin exceeds the amount of post-consumer plastics recovered from the waste stream. The primary market for recycled PET bottles continues to be fiber for carpet and textiles, but packaging, including bottles, is the fastest growing market for recycled PET. The primary market for recycled HDPE is bottles, according to the American Chemistry Council (ACC). Looking forward, new end uses for recycled PET bottles might include coating for corrugated paper and other natural fibers to make waterproof products like shipping containers. PET can even be recycled into clothing, such as fleece jackets.

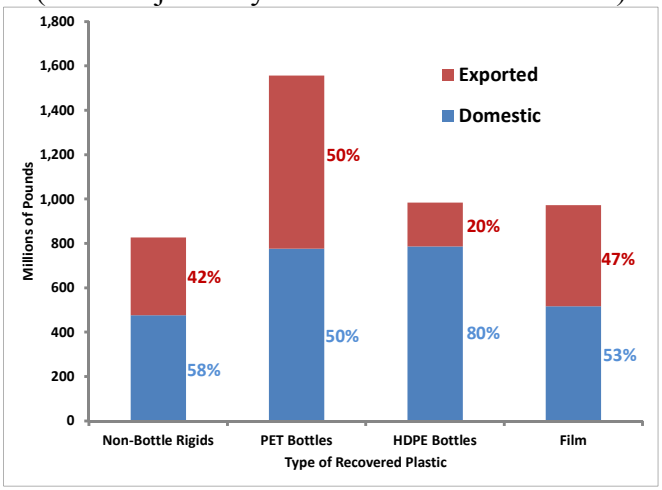
Natural HDPE postconsumer recycled resin's primary markets continue to be for nonfood application bottles, such as for detergent, motor oil, household cleaners, and for films. Pigmented HDPE postconsumer recycled resin's markets continue to be pipe and lawn and garden products and non-food bottles. Plastic lumber consumes a broad range of materials including recycled HDPE, LDPE, mixed rigid containers, and wide-spec virgin resin.

## 2.8 Export Markets

Approximately 41 percent of all postconsumer recyclable plastics collected in the U.S. were exported, primarily off-shore. Figure 2-10 displays the four major recyclable plastic commodities, the total amounts recycled, and the comparison of domestic purchases to export purchases. PET bottles are the most recycled plastic material and also have the largest share exported (50 percent). HDPE is the second most-recycled, but only has about 20 percent exported (or 80 percent purchased domestically in the U.S).

**Figure 2-10**
**Recycled Plastics in 2010: Domestic vs. Exported**

(Four Major Recyclable Plastic Commodities)

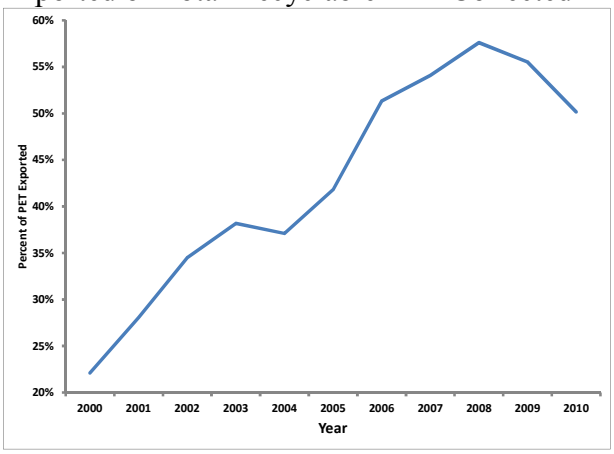



Source: Moore Recycling Associates, unpublished data (June 2012)

Recycled PET exports increased from 22 percent in 2000 up to a high of 58 percent in 2008 dropping to 50 percent of recyclable PET in 2010.[51] Figure 2-11 shows the amount of PET material exported over an 11 year period.

**Figure 2-11**
**Recycled PET Export Trends: 2000 - 2010**

(Percent Exported of Total Recyclable PET Collected in the U.S.)




Source: Moore Recycling Associates, unpublished data (June 2012)

A consequence of these export trends is that domestic manufacturers using recycled PET and PET reclaimers lack adequate supply of clean PET bottles. NAPCOR calculates that in order to meet recycled PET demand from publicly announced brand owner recycled content commitments, as well as current and projected demand from all other recycled PET applications, the PET bottle recycling rate will need to be at least 48 percent by 2013. The current recycling rate for PET is around 30 percent.

A good share of U.S. MRFs are shipping their PET bales through exporters to foreign markets (e.g., China). Of all types of plastics, PET bottle recycling in China has the strongest and most well developed infrastructure. The Chinese PET recycling operations often use the higher technology automated sorting and reclaiming equipment. This trend towards more automation and larger capacity PET processing operations is expected to continue. Chinese plastics recycling operations for the other plastic commodities (e.g., non-bottle rigid containers, film) are usually much smaller and use more manual sorting and lower technology processing equipment.

The network of plastics sorting/handling operations in China is very complex and often decentralized, especially for mixed rigid plastics (i.e., non-PET). The material is often handled by several intermediate plastics processors and reclaimers before going to a final end use manufacturer. The low margin, low value, low volume plastics are more often handled by small family businesses, but the recyclable materials are indeed recycled. Recyclable plastics, in general, are too valuable to dump and dispose of or burn, especially in China where labor costs are much lower than in the U.S.

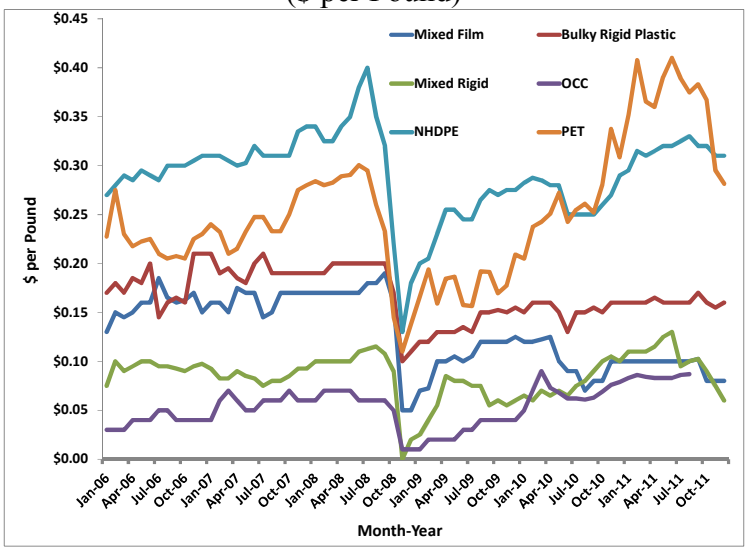
The U.S. needs to grow/build more domestic reclamation capacity for certain types of plastics, especially minority resins such as PVC, PP, and PS. This is an opportunity and should receive additional development efforts in Wisconsin. The China /Asian market has been strong in the past, but both countries will continue to grow their own domestic supplies of recyclable plastic. Today, only 30 to 40 percent of the recycled plastic used in China is imported; the remainder comes from China's growing domestic collection systems. This import share is expected to decrease as China has adopted a Five Year Plan with a target of recycling 80 percent for all resources.[52]

## 2.9 Economics

The role of plastics in the economics of community recycling programs has increased in relative importance. The price per pound for plastic is the second highest of the commonly recycled materials, behind only non-ferrous metals. Figure 2-12 displays a summary of market price trends over six years for the five major recyclable plastic commodities: mixed film, mixed rigids, natural HDPE (NHDPE), bulky rigid plastic, and PET. Old corrugated containers (OCC) are also included in this chart as an example of how other commodities have trended over the same time period.

## Figure 2-12
## Market Price Trends: 2006 – 2011

($ per Pound)




Source: Moore Recycling Associates, unpublished data (June 2012)

## 2.10 SPI/ASTM Plastic Resin Identification Codes (RIC)

The Society of the Plastics Industry (SPI) resin identification code (RIC) plays a role in communicating recycling requirements to the public, and has been criticized recently for increasing confusion regarding what plastic types are recyclable. The system was originally developed in 1988 to provide a consistent national system to facilitate recycling of post-consumer plastics through the normal channels for collecting recyclable materials from household waste. The code was originally developed to meet recyclers' needs while providing manufacturers a consistent, uniform system that could apply nationwide. Table 2-6 lists the RIC codes and full name of each resin type.

## Table 2-6
## Resin Identification Codes and Full Name of Each Resin Type

| | |
|---|---|
| 1 PETE | Polyethylene Terephthalate, PET |
| 2 HDPE | High Density Polyethylene, HDPE |
| 3 V | Polyvinyl Chloride, PVC |
| 4 LDPE | Low Density Polyethylene, LDPE |
| 5 PP | Polypropylene, PP |
| 6 PS | Polystyrene, PS |
| 7 OTHER | Other |

SPI[53], the U.S. Federal Trade Commission (FTC), and other related trade organizations provide guidance for the proper use of the codes during the manufacturing of plastic bottles, other rigid containers, and film plastics.

### 2.10.1 Wisconsin's Plastic Container Labeling Law to Enhance Recycling of Plastic Bottles

In 1987, Wisconsin became one of the first states to pass a law ( s. 100.33, Wis. Stats.) requiring the use of the resin codes on plastic containers.[54] The statute included a requirement for the implementing state agency to make an effort to develop rules consistent, to the greatest extent practicable, with national industry-wide plastic container coding systems. The law phased in the requirements for such labeling of bottles of 8 fluid ounces or more beginning in 1991. In 1990, the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) adopted the administrative rules (ATCP 137, Wis. Adm. Code) to clarify and implement the requirements of the statutes as part of the Environmental Labeling Law.[55] Today, there are a total of 39 states with RIC coding requirements for plastic containers.

### 2.10.2 Commentary on the RIC Codes

Wisconsin was one of the leaders in the development of the resin code system to assist in the identification, sorting and recycling of plastic containers. The intent was not to declare the container as being recyclable, but rather to simply identify its resin. This original strategy for a resin coding system, while laudable, did not fully anticipate the unintended consequence of other plastic containers and plastic items also being labeled with the triangle chasing arrows and resin code number. Soon after the original SPI resin code system was announced, many manufacturers rushed to add the code stamps to their plastic packaging and other products. The implied, and sometimes explicit, message to consumers was "This package has a resin code stamped on it; therefore it is recyclable." In some cases, the codes became a classic form of "greenwash" whereby manufacturers made claims that the material was recyclable when, in fact, there was no feasible collection, processing or marketing programs in place for that specific type of container. Community recycling program coordinators throughout the U.S. have been struggling with these conflicting messages about recyclability of plastic containers ever since.

This study intentionally tries to minimize the use of the ASTM plastic RIC codes as shorthand terminology. Use of the numbers exclusively is confusing because they do not describe the form of the container (e.g., blow-molded bottle vs. injection molded container vs. thermoform clamshell vs. blown film), just the resin type. For example, a well-intentioned community may wish to expand their list of plastics to include resin types "#3 through #7" without ever explicitly stating their objective to also add non-bottles made from PET (e.g., thermoform clamshells such as berry containers) and non-bottle HDPE containers (e.g., yogurt cups and margarine tubs).

# 3 Current Plastics Recycling Systems in Wisconsin

The plastics recycling systems in Wisconsin involve entities ranging from government and private company collection/processing programs to sophisticated industrial grade recycled plastic product manufacturers and reclaimers. Post-consumer plastic types collected and recycled range from simple PET and HDPE bottles-only to a complete list of all plastics, including bulky rigid plastics and selected film plastics. A significant amount of plastics, about 574,000 tons, still remains in the waste stream and is disposed of in landfills or (to a far lesser extent) waste-to-energy facilities serving Wisconsin communities. These materials are technically and economically "recyclable" plastics, which if recycled, represent a value at today's prices of about $43 million.

This section describes the various recycling systems as they exist today, including identification of opportunities for improvement.

## 3.1 Collection and Processing Programs

Wisconsin's recycling laws apply equally to all residential and non-residential locations throughout the state. Local governments, including the Responsible Units, implement and enforce municipal recycling programs to help ensure that residents, businesses and special event managers comply with state and local recycling requirements. Section 1.3.3 discusses the legal requirements for these programs.

Collection and separation of plastics for recycling is carried out by both public and private entities, which often have overlapping service areas. The vast majority of data available on the amounts and types of plastics recycled included in this report are from reports to the DNR by self-certified MRFs or by RUs. The reports include tonnages and commodities accepted and processed and/or marketed. The limits of the DNR data are discussed in more detail in Section 1.4 of this study.

According to analysis by DNR staff, about 80 percent of the RUs account for 20 percent of the population and 20 percent of the total tonnage of recyclables collected.[56]:

- 698 of the RUs have less than 2,000 people and represent about 11 percent of the population of the state and 11 percent of the tons of recyclables.
- 188 of the RUs have between 2,000 and 5,000 residents and represent about 10 percent of the state's population and 12 percent of the tons of recyclables.
- 171 of the RUs have over 5,000 people and represent 79 percent of the state's population and about 78 percent of the tons of recyclables.
-

The six largest RUs with over 100,000 in population are:

- Eau Claire County
- Outagamie County
- Waukesha County
- City Of Milwaukee
- City Of Madison
- City Of Green Bay

Thirty six (36) percent of the RUs have drop-off facilities, usually at town, city or county public works facilities. Fifty-two (52) percent of the RUs provide or contract for curbside collection of recyclables, and twelve (12) per cent of the RUs provide a combination of curbside and drop-off services. The remainder of the recyclables collection programs are provided directly by private haulers to individual homeowners and businesses (open hauling).

There is considerable overlap in the geographic areas served by public and private collection programs and publicly operated drop-off facilities, especially in more rural areas of the state. For instance, the Town and unincorporated area of Presque Isle in northern Wisconsin has a transfer station and recycling drop off center that is open five days per week, including Saturday and Sunday. But Eagle Waste and Recycling also provides waste and recycling collection services to homes and businesses in Presque Isle and surrounding communities. Both programs accept all PET and HDPE bottles; Presque Isle allows all bottles although Eagle prohibits oil bottles from recycling.

In Wisconsin, a materials recovery facility (MRF) is defined by DNR as a facility that processes the materials subject to the disposal and incineration ban for reuse or recycling.

To qualify as a MRF that RUs may use, facility owners must:

- Meet the general requirements for a MRF under s.NR 544.16, Wis. Adm. Code;
- Be self-certified with the DNR prior to processing recyclable materials for an RU; and
- Annually renew the self-certification.

Self-certified MRFs are those MRFs that receive banned recyclable materials directly or indirectly from an RU recycling program and submit reporting forms to the DNR. The MRFs that do not handle or process materials for RU recycling programs do not need to be self-certified with the DNR. Also, MRFs that process only one of the listed recyclable materials, such as newspaper or plastic containers, are conditionally exempt from self-certification provided that they meet the general operating requirements for all MRFs. Facilities that accept only plastics from commercial customers are not required to report recycled plastic tonnages to the DNR and are not generally represented in the DNR data reports. MRFs that accept materials from both RUs and commercial customers report the total tonnage of materials processed from both customer streams.

There are more than 85 registered MRFs in the state. Fifty-five percent of the MRFs are privately owned and/or operated, and forty-five percent are county or municipal facilities. Most rural MRFs are county, township, town or city drop-off facilities. These drop-off facilities are often designed to receive source-separated recyclables into specific containers (e.g., newspapers, cans, glass, plastics). These drop-off facilities often include containers for bagged garbage and areas for large, “bulky items” (including “white goods” such as large appliances like stoves, refrigerators, washers, dryers, etc.) in addition to the traditional recyclables.

Most public drop-off facilities report that they accept residential and commercial or institutional recyclables. Approximately 15 percent of the community programs report that they ship recyclables to larger commercial facilities for processing and marketing. Several MRFs receive recyclables for processing and marketing from smaller public MRFs or public and private transfer stations. Most of the larger facilities receive both residential and non-residential

materials. Thus, when aggregating data on a statewide basis, there is always the challenge of trying to avoid "double-counting" of recyclables tonnages. DNR has made efforts to avoid such double-counting through the reporting processes but this may still occur inadvertently.

Data compiled by Moore Recycling based on research done in 2010 and 2011 for the report *"Plastics Recycling Collection: National Reach Study"* published May 2011, documents that in Wisconsin cities of over 10,000 population, nine percent of the residents had access to recycling for all plastics, 24 percent had access to recycling of all bottles, containers and specific plastics, and 31 percent are able to recycle only PET and HDPE bottles. All cities of over 10,000 population had some form of plastics recycling available to their residents. The specific data are detailed in Table 3-1.

## Table 3-1
## Access to Recycling of Specific Plastic Types

(Wisconsin Cities of 10,000 population or Greater)

| Types of Plastics that City Accepts | Percent of WI Cities Accepting |
|---|---|
| No plastic | 0% |
| All rigid plastic | 9% |
| All bottles and containers and specific plastics | 24% |
| All bottles and containers | 17% |
| All bottles and specific plastics | 0% |
| All bottles only | 10% |
| PET and HDPE bottles and specific plastics | 8% |
| PET and HDPE bottles only | 31% |

Source: Moore Recycling Associates unpublished data on Wisconsin recycling collection programs as a subset of the *Plastic Recycling Collection: National Reach Study* (May 2011)

In the 2010 reports to DNR, four public facilities noted that they receive plastics comingled with other containers (e.g., dual stream recycling with rigid cans, bottles and plastics separated from paper grades). Facilities that reported in 2010 that they received plastics as part of single-stream recyclables collection (i.e., with all paper and rigid containers commingled into one recyclable stream) are listed in Table 3-2 below.

# Table 3-2
# Single-stream MRFs

**(Self-Certified MRFs for Data Year 2010)**

| Self-Certified MRFs | Location |
|---|---|
| Adams County | Friendship, WI |
| Barron County | Almena, WI |
| Town of Cedarburg | Cedarburg, WI |
| Columbia County | Pardeeville, WI |
| Great American Disposal Company | Kingsford, MI |
| Industrial Recyclers of Wisconsin | Mosinee, WI |
| Jackson County | Black River Falls, WI |
| Janesville Recycling Center | Janesville, WI |
| Johns Disposal Service | Whitewater, WI |
| One Source Recycling (Hobart) | Roscoe, IL |
| Town of Ottawa | Dousman, WI |
| Outagamie County | Appleton, WI |
| Paul's Industrial Garage (Pig) | Hager City, WI |
| Pellitteri Waste Systems Inc | Madison, WI |
| Portage County | Plover, WI |
| Resource Management | Chicago Ridge, IL |
| Rock Disposal, Inc. | Janesville, WI |
| City of Shawano | Shawano, WI |
| Tri-R Project | Whitehall, WI |
| Veolia Environmental Services | Chilton, WI |
| Veolia Environmental Services | Eau Claire, WI |
| Veolia Environmental Services | Kenosha, WI |
| Veolia Environmental Services | Marshfield, WI |
| Veolia Environmental Services | Minocqua, WI |
| Veolia Environmental Services | Waunakee, WI |
| Veolia Environmental Services | Schofield, WI |
| Waste Management | Germantown, WI |
| Waste Management | Lacrosse, WI |
| Waste Management | Madison, WI |
| Waste Management Recycle America | Superior, WI |
| Waste Management Recycle America | Minneapolis, MN |

Source: WI DNR *MRF Reports for 2010*

Commingled collection of recyclables (e.g., single-stream recycling) is growing more frequent in Wisconsin. Upgraded MRFs that can separate plastics into end-usable grades, and additional intermediate processing facilities that can add value to the mixed plastics collected, are important opportunities for business and jobs development in Wisconsin. The addition of these facilities to the "local" scene will provide Wisconsin end-users with more reliable and cost-competitive sources of material by promoting local collection and MRF programs and reducing transportation costs.

The majority of the processing and marketing tonnage as reported to DNR for 2010 was privately owned and/or operated. Table 3-3 lists the largest 20 MRFs in Wisconsin. These top 20 MRFs reported processing about 608,900 tons in 2010 or about 74 percent of Wisconsin total reported recyclables. Sixteen of the top facilities are private, processing 516,600 tons (85

percent) in 2010. Of the top 20 MRFs' plastics tonnage, 19,200 tons (71 percent) were handled by these private facilities.

## Table 3-3
## Wisconsin MRFs 2010 Top 20 Processed Tons

| Facility | Public/Private | Total Tons[1] | Total Plastic Tons [1] |
|---|---|---|---|
| Waste Management – Germantown | Private | 169,300 | 6,200 |
| Resource Management | Private | 86,800 | 4,700 |
| Paper Valley Recycling | Private | 47,400 | 1,200 |
| Outagamie County | Public | 45,500 | 3,600 |
| Waste Management – Madison | Private | 36,300 | 1,400 |
| Johns Disposal Service Inc. | Private | 30,500 | 2,200 |
| Commercial Recycling Corp | Private | 25,300 | 900 |
| Waste Mgt Recy. America - Twin Cities | Private | 25,200 | 200 |
| Janesville Recycling Center | Private | 22,500 | 1,100 |
| Veolia Environmental Services (Madison) | Private | 22,200 | 160 |
| Waukesha County | Public | 20,300 | 1,700 |
| City of Milwaukee MRF | Public | 18,400 | 1,500 |
| Allied - Minneapolis Recyclery | Private | 13,900 | 800 |
| IROW (Formerly Industrial Recyclers of WI) | Private | 13,800 | 0 |
| One Source Recycling of Wisconsin LLC | Private | 11,800 | 0 |
| Waste Management Recycle America - Madison | Private | 9,500 | 0 |
| Veolia Environmental Services (Kenosha) | Private | 8,400 | 500 |
| Veolia Environmental Services (Eau Claire) | Private | 8,300 | 0 |
| Portage County | Public | 8,200 | 1,000 |
| Waste Management - La Crosse | Private | 7,900 | 0 |
| **Top 20 Facilities, Private, Tons** | | **516,600** | **19,200** |
| **Top 20 Facilities, Public, Tons** | | **92,300** | **7,900** |

1. Rounded to the nearest 100 tons

Source: WI DNR *MRF Reports for 2010*

Five MRFs reporting to DNR that serve residents in the state are located outside of Wisconsin: three are in Minnesota, one is in Illinois and one in Michigan and all are private facilities. Together in 2010 these five MRFs reported handling 20 percent of Wisconsin recyclable materials and 17 percent of all Wisconsin plastics.

Certain of the larger private MRF owners have announced that, in association with the single-stream recycling programs they are operating, they will accept a wider variety of plastic recyclables. Most often these are promoted as "accepting all plastic except foam," or "We take all plastics." Companies that have made the plastic types "1 through 7" announcement, such as Veolia in Sheboygan County, often state they do not want "Styrofoam" (i.e., EPS) included in the recycling stream. These companies state that EPS can be a contaminant when they are recycling other plastics.

The consultant team conducted a series of interviews with MRFs and various recyclable plastics markets. (See Appendices 3-A through 3-P for more details of these interviews and other case studies.)

### 3.1.1 Collection and Processing of non-PET and non-HDPE plastics.

Based on the findings from this study, a significant number of private companies are now accepting a wider range of plastic types (e.g., RIC #1 through #7). This relatively recent expansion of the list of plastics collected in Wisconsin's municipal recycling programs is one of the reasons that DNR is re-examining its disposal ban variance for the for the non-HDPE and non-PET plastic types (i.e., RIC types #3 through #7).

Not all public MRFs have made the change to add plastic types #3 - #7. For example, Outagamie and Waukesha Counties' MRFs still process and market only PET (RIC #1) and HDPE (RIC #2) bottles. (See Appendices 3-A and 3-B for more details and interview results.)

The City of Madison has been a leader in collecting a broader list of plastic types #1 through #7. (See Appendix 3-C for more details and a link to the City's web page.) In the past, the City was collecting "all plastic bottles". At the beginning of 2012, the City further expanded their list of recyclable plastics to include:

- Plastic bags including grocery and retail bags, produce bags, newspaper bags (but no dark green or black bags).
- Other plastic containers numbered RIC #1 - #7 (e.g., plastic dairy tubs, including their lids; PET deli and berry clamshell containers).

Prior to 2012, the City of Madison instructed residents to rinse and include the following plastic items in the green, single-stream recycling cart:

- All plastic bottles including plastic jugs, plastic laundry product bottles, PET (RIC #1) peanut butter and condiment jars (but no motor oil bottles).

There is a clear trend throughout the industry, both public and private, to collect more types of plastics. But it is primarily the private recyclers and plastics markets that are driving the trend towards collecting and processing all rigid plastic containers (RIC #1 through #7). The City of Madison and surrounding metro area suburbs, which use the private Pelliterri MRF, now collect a more complete list of recyclable plastics.

There are many examples of communities that collect and process PET and HDPE bottles only. There are also a number of good examples of communities that collect and process some form of a broader list of plastics (e.g., "all bottles", "all rigid containers", RIC types #1 - #7, etc.)

According to the 2009 National Report on Postconsumer Non-Bottle Rigid Plastic Recycling by Moore Recycling there are compelling reasons to add non-bottle rigid plastics to recycling collection programs:

- Many MRFs are already pulling and selling non-bottle rigid plastic.
- Domestic and export markets are available.
- Several mixed resin grades have a high scrap value (> $ 200 per ton).
- A steady supply encourages domestic investment in reclamation capacity.
- Manufacturers need assurance that there will be a steady stream before they invest in using postconsumer resin (PCR).

- Collecting additional plastic types has the potential to reduce public confusion about which plastics can be recycled and to increase the volume of the already-collected plastic types by encouraging consumers to save all rigid plastic.
- Collecting all rigid plastic provides an opportunity to increase diversion/recycling rates.
- Satisfying public demand for the broadest possible range of materials acceptable for recycling.

If the DNR amends its variance to include a broader list of recyclable plastics in the State disposal ban, it appears that many communities will have adequate recycling collection and processing capacity to accept, process and market these commodities, especially if there is adequate notice and lead time. Several of the MRFs and plastic markets interviewed reported that they have unused facility capacity, which could accommodate additional plastics volume by adding additional shifts. (See Appendices 3-A, 3-B, 3-D, and 3-E for more details on interview results.)

The infrastructure available in many of the collection systems (carts, trucks, drop-off locations) appears to be sufficient to accept additional plastic recyclables, especially for the larger MRFs. New technologies (e.g., automated plastic sorting technologies) recently added to some of the largest MRFs were designed to separate additional plastic types for identified markets. (See Section 2.5 for more details about automated plastic sorting technologies.) Some of the smaller MRFs, however, were designed to handle only PET and HDPE bottles and would require significant capital equipment investments to handle additional plastic types (e.g., to add sorting and storage capacity).

Many cities and towns have ordinances in place which would accommodate a statewide decision to expand the types of plastics banned from disposal. For example, Presque Isle, cited as an example above has a requirement in its Recycling Ordinance (Chapter 110. Subchapter 108) for separation and recycling of "Foam Polystyrene packaging,… and plastic containers made of PET, HDPE, PVC, LDPE, PP, PS and mixed or other plastic resin types." Separation of these items is exempted in the ordinance if a variance or exemption has been granted by DNR for the material, as is now the case. If the DNR ends the variance on the disposal ban for certain plastics, the local Presque Isle ordinance, and other similar ordinances to support recycling of the banned plastics are already in place.

### 3.1.2 Film Plastics

Preliminary results of interviews indicate there may not be adequate MRF capacity for film plastics (e.g., grocery bags) from curbside recycling programs. Several of the MRF operators that were interviewed in this study indicated that they cannot cost-effectively add film plastics to their recycling stream because of the operational and equipment problems that they pose. (See Section 2.4.2 for more details on the challenges of processing film in MRFs designed primarily for sorting of paper and rigid containers.)

Nationally, and in many areas of Wisconsin, there is infrastructure in place for separate recycling of plastic film, wraps and bags through drop-off bins at retail locations (e.g., larger grocery stores). The film collected from consumers is typically combined with pallet wrap generated in the back of the stores and "back-hauled" to established markets by the individual retail companies. The film collected constitutes an additional revenue stream for the retail companies, providing an incentive for these stores to dedicate floor space to the program.

These locations are generally operated voluntarily by large vendors (large grocery or retail chains) and may not be available in rural areas or in all parts of large cities. Also, this retail drop-off collection program is susceptible to discontinuation because of its voluntary nature. Retailers could end collection for business or space reasons, although considering the current competition for film by processors; it is unlikely that businesses would give up this revenue. If a significant number of these voluntary programs cease, or if statewide expansion of the take-back locations does not occur, alternate programs could be considered.

Alternative curbside film collection methods are in operation in the City of Madison and in selected communities in Minnesota. Pelliterri Waste Systems, Inc., the City of Madison's current recyclables processing contractor, is accepting the curbside film at its MRF, but is not yet promoting it. (See Appendix 3-C for more details on the City of Madison case study.) Pelliterri reports that the handling of curbside film is not yet cost-effective and reduces the efficiency of processing other commodities in their MRF. Outagamie County also reported significant maintenance issues due to plastic bags from curbside recycling programs, even though they do not formally accept plastic bags in the curbside program (see Appendix 3-A for more details).

Allied has begun accepting plastic bags from its Minnesota route customers, and hopes to minimize the deleterious processing effects of plastic bags by requesting that "all bags be in bags." When plastic bags are contained in plastic bags, Allied has found that it is relatively easy to remove them from a picking line. Waste Management, in contrast, is not accepting plastic bags in its curbside programs. Outagamie County and Waukesha County do not anticipate adding bags to their accepted recyclables because of the increased maintenance and equipment damage that bags entail.

## 3.2 Away from Home Collection Programs

"Away from home" recyclables collection is a term of art that encompasses a variety of commercial and institutional venues and facilities used by the general public while on the road or otherwise away from home or the office. Away from home includes gas stations, convenience stores, restaurants, bars, government buildings (e.g., administrative, schools, etc.), park facilities, other recreational and entertainment facilities, etc. These are public places where trash is generated and that also need recycling service opportunities. Away from home recycling is a relatively new and largely undeveloped program initiative.

Non-residential recycling is required by Wisconsin law. Recycling of the banned items is required at non-residential facilities, including parks, schools, events and commercial establishments. Each RU is required to provide information to owners and managers of properties and enforce compliance with the laws. In reality, it is very difficult for the state or for individual RUs to oversee and enforce recycling compliance at private businesses and events, and this, therefore, has not been an area of emphasis for RUs. There are some individual success stories across the state, and some citizens understand the need to recycle and are requesting away from home recycling opportunities.

The amount of plastic recyclables disposed of from residential and other commercial sources is much larger than the recyclables disposed of at away from home locations. But there is considerable educational value in recycling opportunities provided at away from home locations.

The general public will take recycling more seriously if it becomes standard practice like trash disposal. If trash cans are paired with recycling bins, it will be much easier to train the public to recycle. Plus, away from home recycling programs reinforce the recycling message and provide a more convenient recycling service (compared to storing recyclables in the car to take home or the office for recycling).

The Recycling Association of Minnesota (RAM) is implementing the "Message in a Bottle" away-from-home recycling campaign. They have found that an average convenience store collects approximately 2,000 pounds per year of plastic bottles when separate containers to recycle bottles are provided. The RAM program has placed recycling bins shaped like giant soda bottles at convenience stores in fifteen communities statewide since 2007, and 1,000,000 pounds per year of bottles have been collected. RAM partners with local jobs programs to collect and process the bottles from the individual convenience stores. In the Minneapolis-Saint Paul metro area, for instance, RAM partners with ProAct, Inc., a nonprofit organization providing employment opportunities to individuals with disabilities, for the collection and sorting of the beverage containers.[57]

The web site, *Recycle MORE Wisconsin.org*, promotes Away From Home recycling[58]. The page, maintained by the Associated Recyclers of Wisconsin (AROW), contains how-to tips and downloadable signage for recycling receptacles. It notes that recycling of certain materials is required by state and local law at special events and festivals, and that recycling and other waste reduction efforts can reduce disposal costs and generate extra revenue for the event.

### 3.2.1 Highway Rest Stops

Wisconsin has a well-developed system of recycling at the 30 rest areas on the Interstate Highway system and other major four lane highways. Each rest area is open year round and has a recycling center convenient to the public for drop off of recyclables, including plastics. Some "waysides," located on two lane highways and open seasonally, have recycling drop-off facilities.

At each State rest area, a separate sorting area is provided for sorting of recyclables for transportation and marketing. Sorting is done by people employed by the Local Community Rehabilitation Programs (CRP), an employment program for persons with disabilities. The CRPs at the individual rest areas are supervised by Rehabilitation for Wisconsin (RFW), a private nonprofit organization[59]. Because the recyclables are included in contracts for wastes and recyclables hauling that the Wisconsin DOT administers, tonnages of waste and recyclables are not reported to DNR. Also, there is no information provided to confirm that separated recyclables are hauled separately and delivered to MRFs or processing facilities.

### 3.2.2 Parks and Recreation Facilities

Most Wisconsin state parks and forests with campsites, building and picnic areas generally do not have trash cans. Recycling bins are often available for glass, plastic, aluminum and tin. Those areas that do not have garbage or recycling bins are designated as "carry-in, carry-out," and visitors are expected to take recyclables and trash home with them for recycling and disposal.

City and County parks have requirements specific to the jurisdiction, some of which may include a recycling requirement. For example, in Madison, persons that wish to reserve a park for a special event must complete an application, which includes a Clean Up and Recycling Plan. Also, the City of Madison Parks Department conducted a pilot recycling program in 2009. This pilot is continuing and consists of 30 recycling carts concentrated in high use areas. (See Appendix 3-C for more details on this pilot project.) Challenges encountered included: lack of adequate staff, appropriate recycling carts; adequate collection vehicles; and high contamination rates.

### 3.2.3 Public Spaces

Government entities are generally responsible for providing recycling opportunities at events held in their facilities (e.g., parks, convention centers, public sports facilities, etc.). Local governments who allow the use or lease of their buildings and grounds for festivals or other events must provide for recycling either by arranging for the service themselves or requiring the event organizers to provide recycling opportunities.

While such recycling service is required by the *Wisconsin Recycling Law*, this requirement is not uniformly enforced or universally carried out. The City of Milwaukee, for example, licenses events through the Special Events Permits.[60] The permit references the need to provide "Dumpsters, garbage carts, and barricades" but not recycling containers.

### 3.2.4 Sporting Facilities

Large sports facilities represent a venue where recycling, although required by law, is usually not available. The larger fields are beginning to provide recycling opportunities, and educate customers and teams to the importance of recycling, but there are many opportunities for improvement.

One example of a successful recycling program at a sports stadium is the recent Milwaukee Brewers / Miller Field initiative. During the 2012 season, the Brewers worked with Keep Greater Milwaukee Beautiful, DNR, a corporate sponsor and volunteers from two local environmental groups on a pilot "blue bag" program for tailgaters. The pilot consisted of volunteers handing out blue bags to tailgaters in three lots during six home games. The volunteers then instructed the tailgaters where to place the bags for recycling. Blue bag tailgating programs successfully undertaken by several major league football teams were the model for this program. The pilot project has been very well received by fans and it netted a 40 percent increase in materials recycled. The Brewers report, on average, Miller Park recycles approximately seven to eight tons of waste from every home game. (See Appendix 3-F for more details about the Brewers / Miller Field case study.)

There are significant challenges to designing and implementing a sustainable recycling program at sporting facilities. The Green Bay Packers, Inc. attempted to set up a recycling program at Lambeau Field in during the 2007 – 2008 season. Several tons of recyclables were collected using a variety of creative recycling containers designs (e.g., huge Packers helmets as recycling bins) and locations (e.g., in the parking lot to serve the tailgating crowds). In the end, the program was discontinued and the web page description for this recycling initiative has been removed from the Packers web site. (See Appendix 3 – G for more details about the Packers / Lambeau Field case study.)

National programs have been initiated to develop various recyclables collection options at sports facilities around the country. Past experiences have been informative about the challenges of providing effective, sustainable recycling services at sports stadiums and other such venues (e.g., motor sports events, golf tournaments). One option is to combine the use of recycling bins with a post-event collection or "pick" of the entire stadium to recover recyclables that fans leave at their seats. Supplementary picks can employ clean-up workers who pick recyclables from the ground litter separately from trash. A large volume of recyclables can be recovered from these picks if the workers sort trash/litter from recyclables as they pick up each item.

For stadiums that are very large and have huge crowds, bins may not be practical and post-game picks alone can be used. The ability of municipal and other recycling program managers to successfully educate the fans and monitor recycling bins is limited. It is common for such sports events bins to be heavy with contamination that render the material non-recyclable. In part this is due to the "culture" of certain events, which allows fans to leave their trash and recyclables at their seats with the expectation that it will be cleaned up. In these situations, post-game picks alone, if properly planned and managed, have been proven to recover a significant amount of recyclables with very little, if any, added labor cost. Stadium picks can typically recover 90 percent of the single-serve bottles sold or generated at the venue.[61]

### 3.2.5 Convention facilities

Convention facilities, similar to sports arenas and parks, are challenging venues for away from home recycling services due to the highly mobile participant populations and changing customers for each event. The Alliant Energy Center (Madison, WI) is one good example of sustaining a cost-effective set of recycling services at such convention facilities. The Alliant Energy Center is a major convention facility hosting expositions, conventions, meetings, concerts, sporting events, etc. There are recycling containers in all permanent buildings, and in outdoor areas for outdoor events. The recyclables containers are handled in a single-stream system. (See Appendix 3-H for more details on the Alliant Energy Center case study for convention facility recycling programs.)

## 3.3 Diversity of Plastics Recycling Public Education Messages

As noted above, there is overlap in the local government and private recycling programs that are offered to Wisconsin residents. This overlap of recycling collection and public education programs also means that there is a large variety of how plastics are described and listed for recycling. Foth conducted a scan of selected Wisconsin city web pages. (See Appendices 3-A through 3-E, and Appendix 3-I for examples of various lists of recyclable plastics as per the selected city web pages.)

Moore Recycling Associates, as part of a Nation-wide effort, surveyed some Wisconsin communities to understand the diversity of plastics recycling messages. Table 3-4 is a small sample of how various communities define recyclable rigid plastics.

## Table 3-4
## Examples of Definitions Used by Wisconsin Communities To Define Recyclable Rigid Plastic Containers

- *All Household Containers 1-7*
- *All Plastic Containers*
- *All Rigid Plastic Containers*
- *Plastic Tubs and Bottles*
- *Rigid Plastics with the Recycling Numbers 1-7*
- *All Bottles and Containers Labeled #2, 4, or 5*
- *All Bottles and Containers 1-7*
- *Plastics - Milk cartons, soft drink liter bottles, water bottles, liquid detergent bottles, fabric bleach bottles, shampoo bottles*
- *All household product containers with #1, #2, #3, #4, #5, #6 & #7 stamp and plastic toys and tools if identifiable by one of these numbers.*
- *Any material made of plastic; the recycling code is not necessary*
- *Plastics Labeled 1-7*
- *All Plastic Bottles, Tubs and Lids*
- *All plastic labeled on or near the bottom with a 1–7 recycling symbol*
- *Plastic Food and Beverage Containers (bottles and tubs)*
- *PET: soft drink bottles, photo film*
- *All Clean Plastic*

Source: Moore Recycling Associates rigid plastic container survey conducted for ACC, unpublished data specific to Wisconsin communities.

The diverse means of describing what types of plastics are recyclable can be confusing to the public, especially as people are exposed to multiple recycling programs through their home, work and other locations. There may be lost opportunities to use regional and statewide mass media if there are no standardized definitions of recyclable plastics. As discussed in Section 2.2.1, this situation of multiple and conflicting public education messages about recyclable plastics is not unique to Wisconsin. The challenge of consistent messaging without a standardized list of recyclables is not limited to plastics, but because of the increasing types of plastics and changes in what is accepted, the lack of standardization is probably greatest for plastics.

This problem has recently become more pronounced as some of the private waste management firms have announced their ability to take all plastic containers. In addition to the processing issues discussed in Section 3.1, common definitions and understandings of which plastics are accepted, and which are not, is very important to ensure Wisconsin maintains the most cost-effective recycling programs possible.

## 3.4 Markets

Markets for this study are defined as those companies that process recyclable plastics from community programs and commercial establishments. Plastic markets are companies that further process and add value to recyclable plastics and are known by a variety of definitions and categories, including:

- Intermediate plastic processors (sorting, baling, extrusion, etc.).

- Plastic recovery facilities (sorting, baling, reclaiming, etc.).
- Reclaimers (sorting, washing, grinding, pelletizing, and/or compounding).
- End-use manufacturers (makes new products).

The above market categories are often overlapping. Some end-use manufacturers are vertically integrated to include sorting, washing, regrinding, and pelletizing. In any case, there is no commonly used standard for categorizing recyclable plastics markets, and these definitions differ within the plastics and recycling industries.

MRFs are included under the broader definition of "buyers" of recyclable plastics. In this study MRFs are not included in the definition of plastics "markets."

Development of added-value processing capacity represents a significant opportunity for the state to grow both jobs and corporate tax base. The addition of processing capacity in the state will significantly reduce the cost of obtaining recycled content for those manufacturers that are located in Wisconsin, giving them a competitive edge over outstate firms. One manufacturer in the state noted that if they could obtain plastics processed within the state, their cost of transportation would be reduced by eight cents per pound, which would greatly increase their competitiveness in the global marketplace.

Many buyers were identified that are located outside of Wisconsin in the neighboring states of Iowa, Illinois, Indiana, Michigan, and Minnesota. This study also listed and characterized an additional 10 major markets in the U.S. that handle over 100 million pounds of recycled plastics per year. These additional markets outside of Wisconsin, including exporters and foreign markets, influence the global marketplace of plastics recycling and provide the broader context for this study.

### 3.4.1 Intermediate Plastic Processors and Plastic Recovery Facilities

Intermediate plastic processors take in baled or loose plastic that has been separated from other recyclable materials by commercial generators, MRFs and buyback or drop-off centers. Intermediate processors then granulate the material for sale to reclaimers or as commercial regrind to end-users. In some cases, MRFs and other post-consumer collection facilities sell mixed resin plastic to plastic recycling facilities (PRFs). Most PRFs are designed to separate mixed plastics into their individual resin categories and may further separate certain plastic resin types by color or other market specification parameters. These segregated plastic resins are fed into granulators at PRFs and sold to reclaimers as "dirty regrind." Another major function of the plastics intermediate processor is the sorting and removal of contaminants from the plastic resin streams they process.[62]

### 3.4.2 Reclaimers

These companies purchase post-consumer plastics from collectors, MRFs and PRFs. Using various technologies; they produce clean flake or pellets for resale or for use in their own end-products. Technologies used to reclaim plastics include sorting, grinding and washing with a chemical wash process. Many reclaimers also have sink-float systems that separate materials by difference in specific gravity. Reclaimers may use screening and de-dusting to remove additional contaminants from plastic pellets or regrind.

### 3.4.3 End-Use Manufacturers

End-use manufacturers are industrial facilities that purchase recycled plastic from intermediate processors or reclaimers and make new products. The domestic end uses for non-bottle rigid plastics include pipe, buckets, automotive products and other relatively thick-walled injection products such as pots and crates. A significant portion of the non-bottle rigid plastic collected is used in composite products, such as lumber, pallets and railroad ties. In addition, a number of companies compound these materials and sell to manufacturers that make shapes and forms, or roto-molded products such as tanks, drums and carts. Consumer products like cutting boards, toothbrushes and razors are also being manufactured with post-consumer resin (PCR).

The Wisconsin Economic Development Corporation (WEDC) has identified more than four hundred and fifty companies that use plastics to manufacture products in Wisconsin. Not all of these companies presently use recycled plastic content in their processes, but if good-quality recycled resins were available, many of these companies could convert to using a share of recycled plastics and become end-markets.

### 3.4.4 Exporters

Some of the MRFs serving Wisconsin communities use exporters to help market their recyclable plastics. Often these are mixed bales of minority resin types of plastics that require further sorting and processing. A number of companies also serve as brokers in a similar manner.

## 3.5 WI DNR Waste Composition Analyses

In 2009 the DNR contracted for a second in a series of statewide waste composition analyses. The objectives of the study were to determine the statewide aggregate composition by weight for each material type going to Wisconsin landfills, as well as the composition of residential, multi-family residential, industrial, commercial and institutional wastes. The 2009 study was an update to the first state-wide waste characterization study, which was performed in 2002.

Table 3-5 displays a reformatted set of results from the DNR's 2009 waste composition study analysis.

## Table 3-5
## Plastics Remaining in the Waste Stream
(Tons in 2009)

| | | Plastic Type | Residential | ICI | C&D | TOTAL | Percent |
|---|---|---|---|---|---|---|---|
| **PET Bottles/Jars:** | | | | | | | |
| | 10 | PET Beverage Bottles | 7,993 | 9,302 | 39 | 17,334 | 3.0% |
| | 11 | PET Non-Beverage Bottles/Jars | 2,721 | 2,093 | 43 | 4,857 | 0.8% |
| | | **Subtotal of All PET Bottles/Jars** | **10,714** | **11,395** | **82** | **22,191** | **3.9%** |
| **HDPE Bottles/Jars:** | | | | | | | |
| | 12 | HDPE Natural Bottles/Jars | 2,584 | 2,903 | 50 | 5,537 | 1.0% |
| | 13 | HDPE Colored Bottles | 4,286 | 3,501 | 64 | 7,851 | 1.4% |
| | | **Subtotal of All HDPE Bottles/Jars** | **6,870** | **6,404** | **114** | **13,388** | **2.3%** |
| | 14 | Other Plastic #3-#7 Bottles | 2,601 | 1,661 | 30 | 4,292 | 0.7% |
| | | **SUBTOTAL OF ALL BOTTLES/JARS** | **20,185** | **19,460** | **226** | **39,871** | **6.9%** |
| | 17 | Other Rigid Plastic Packaging | 18,929 | 43,264 | 789 | 62,982 | 11.0% |
| | | **SUBTOTAL OF ALL RIGID CONTAINERS** | **39,114** | **62,724** | **1,015** | **102,853** | **17.9%** |
| | | (Percent by sector) | 38.0% | 61.0% | 1.0% | 100.0% | |
| **Film:** | | | | | | | |
| | 18 | Plastic Shopping Bags, Film | 6,025 | 4,313 | 87 | 10,425 | 1.8% |
| | 19 | Plastic Industrial Film Packaging | 1,455 | 42,420 | 224 | 44,099 | 7.7% |
| | 20 | Agricultural Plastic Film | 526 | 8,662 | 41 | 9,229 | 1.6% |
| | 21 | Other Plastic Film | 57,772 | 111,221 | 1,174 | 170,167 | 29.6% |
| | | **Subtotal of All Film** | **65,778** | **166,616** | **1,526** | **233,920** | **40.7%** |
| | | (Percent by sector) | 28.1% | 71.2% | 0.7% | 100.0% | |
| **Polystyrene:** | | | | | | | |
| | 15 | Food Polystyrene Foam | 6,350 | 10,406 | 114 | 16,870 | 2.9% |
| | 16 | Other Polystyrene Foam | 3,830 | 9,676 | 77 | 13,583 | 2.4% |
| | | **Subtotal of All Polystyrene** | **10,180** | **20,082** | **191** | **30,453** | **5.3%** |
| | | (Percent by sector) | 33.4% | 65.9% | 0.6% | 100.0% | |
| **Other Plastics:** | | | | | | | |
| | 22 | Other Plastic | 27,844 | 40,462 | 627 | 68,933 | 12.0% |
| | 23 | Composite (with other materials) | 49,921 | 83,914 | 4,344 | 138,179 | 24.1% |
| | | **Subtotal of Other Plastics** | **77,765** | **124,376** | **4,971** | **207,112** | **36.1%** |
| | | (Percent by sector) | 37.5% | 60.1% | 2.4% | 100.0% | |
| **Total Plastics in Waste Stream** | | | **192,837** | **373,798** | **7,703** | **574,338** | **100.0%** |
| | | (Percent by sector) | 33.6% | 65.1% | 1.3% | 100.0% | |

Source: DNR *2009 Wisconsin State-Wide Waste Characterization Study*

For all categories of plastics, the industrial, commercial, institutional (ICI) sector is the largest source of plastic disposed of at about 65 percent (374,000 tons per year). Residential sources comprise about 34 percent (193,000 tons per year) of plastics disposed of. Construction and demolition sources comprise only about one percent (8,000 tons per year).

**Film**, as a category (including plastic shopping bags), is the largest contributor in the plastic waste stream at about 234,000 tons per year (about 41 percent of total plastics disposed of). Of total film disposed of, about 71 percent comes from the ICI sector. Residential film comprises 28 percent of the total film disposed of. Plastic shopping bags (ID #18) from the residential

sector make up less than three percent of the total film disposed of. It is recognized that agricultural plastic film ("ag film" ID #20) disposal may be under-represented due to onsite disposal including burning.

"**Other plastics**" as a broad category (including composite items made up of plastic plus other materials such as metal, wood, glass) make up the second largest category of plastics disposed of comprising about 207,000 tons per year (36 percent of total plastics). The ICI sector makes up the bulk of these "other plastics" at about 124,000 tons per year (60 percent of the total of "other plastics"). The residential sector comprises about 78,000 tons of "other plastics" (37 percent of total "other plastics").

"**All rigid containers**" as a broad category (including bottles and non-bottle containers) make up the third largest category of plastics disposed of, comprising about 103,000 tons per year and 18 percent of the total plastics disposed of. The ICI sector makes up the bulk of these "rigids" at about 63,000 tons per year (61 percent of the total rigids). The residential sector comprises about 39,000 tons of rigids (38 percent of total rigids).

Finally, **polystyrene** as a category (including food PS foam and other PS foam such as "block & shapes" protective packaging) is the fourth largest category of plastics disposed of, comprising about 30,000 tons per year and five percent of the total plastics disposed of. The ICI sector makes up the bulk of the PS at about 20,000 tons per year (66 percent of the total PS). The residential sector comprises about 10,000 tons of rigids (33 percent of total PS).

Compared to other materials in the entire waste stream, plastics made up about 14 percent of the 2009 statewide wastes. This represents an increase of over 100,000 tons and nearly four (4) percentage points from the earlier waste characterization study conducted for DNR in 2002.

Compared to other materials, plastic and composite plastics were the fourth largest material category in 2009, up from its rank as the eighth largest category in 2002.

These waste characterization data indicate an opportunity to capture plastics in the ICI stream that could be taken advantage of in Wisconsin. Unlike residential generators, ICI generators can be targeted specifically for a given plastic commodity and the recyclable plastics from an ICI facility can be very clean tonnage, easily segregated at the generating facility and therefore requiring minimal processing. ICI businesses with marketable recyclables can obtain revenue from the scrap value of their plastics and can often see cost savings in their waste disposal fees. Table 3-6 displays a preliminary analysis of the amounts and value of ICI plastics disposed of and the potential economic value of the materials if captured and marketed. The value of the ICI plastics in Table 3-5 at reported July 2011 prices with a 75 percent capture rate is about $42 million.

## Table 3-6
## 2009 Statewide ICI Waste Composition Portions of Specific Plastics in the Waste Stream and Potential Value

| Plastic Type | Total ICI Tons[1] | Percent of Waste Tons | Value of "Waste" If Recycled[2] |
|---|---|---|---|
| PET Beverage Bottles | 9,302 | 0.4% | $ 5,441,670 |
| PET Non-Bev. Bottles/Jars | 2,093 | 0.1% | $ 1,224,405 |
| HDPE Natural Bottles | 2,903 | 0.1% | $ 1,349,895 |
| HDPE Colored Bottles | 3,501 | 0.2% | |
| Other Plastic #3 - #7 Bottles | 1,661 | 0.1% | $ 323,895 |
| Food Polystyrene Foam | 10,406 | 0.5% | NV[3] |
| Other Polystyrene Foam | 9,676 | 0.5% | NV[3] |
| Other Rigid Plastic Packaging | 43,264 | 2.1% | $ 9,734,400 |
| Plastic Shopping Bags, Film | 4,313 | 0.2% | $ 646,950 |
| Plastic Industrial Film Pkg. | 42,420 | 2.0% | $ 6,363,000 |
| Agricultural Plastic Film | 8,662 | 0.4% | NV[3] |
| Other Plastic Film | 111,221 | 5.3% | $16,683,150 |
| Other Plastic | 40,462 | 1.9% | NV[3] |
| Composite/Other Plastic | 83,914 | 4.0% | NV[3] |
| **Total ICI Plastics in Waste Stream** | **373,798** | **17.7%** | **$41,767,365** |

1. Mean of sorts, extrapolated total tons in state
2. Assumes recovery of 75 percent of waste material, July, 2011 prices as reported by Moore Recycling Associates, Figure 2-14
3 No or nominal value

The film plastics make up the highest percentage of materials that may be targets for residential recycling diversion. However, these plastics are not compatible with MRF operations and are usually discouraged from residential curbside or city/town/county recyclable drop-off locations. Retail drop-off locations, the industry-preferred residential film plastic collection venue, are not typically sized for a significantly increased film plastic burden.

Some companies have recognized this resource and are capitalizing on it. Trex (Appendix 3-N) has set up an interstate system for backhauling plastics from pallet wrap and container shrink wrap, and use these materials in the manufacture of recycled wood products. Other Wisconsin companies that are recycling plastic film/bags include Wisconsin Film and Bag (Appendix 3-O) and N.E.W. Plastics Corporation (Appendix 3-K). All companies agreed on two points. First, the general public and business establishments need to be better informed of the value of film plastics and that they could save money by being paid for recycling clean film instead of paying to have it disposed of. Second, improved reverse-logistics infrastructure is needed in smaller distribution companies and suburban and in rural areas to aggregate film plastics for film processors or manufacturers. Wisconsin-based film/bag recyclers might especially benefit as their smaller size puts them at a disadvantage to efficiently serve national retail chains that have operations throughout the country (e.g., Walmart, Target).

Table 3-7 displays the relative amounts and value of residential plastics as disposed of. The value of the residential plastics in Table 3-7 at reported July 2011 prices with a 75 percent is over

$22 million. Together with the ICI plastic value in Table 3-6, the total estimated potential value of the plastic as disposed of is over $63 million.

The 2009 waste sort performed separate evaluations of multi-family wastes. The significant differences between the residential and multifamily residential plastic wastes were the lower total percentage of plastics in the wastes (11.8 percent for multifamily vs. 13.4 percent for residential), the higher percentage of PET bottles in multifamily plastic wastes (0.8 percent for multifamily vs. 0.5 percent for residential) and the higher amount of "Other rigid plastic packaging" in residential waste (1.3 percent for residential vs. 0.8 percent in multifamily). These results are not surprising considering the difference in lifestyles and storage habits between residential and multifamily properties.

## Table 3-7
## 2009 Statewide Residential Waste Composition Portions of Specific Plastics in the Waste Stream and Potential Value

| Plastic Type | Total Residential Tons* | Percent of Waste Tons | Value of "Waste" If Recycled[2] |
|---|---|---|---|
| PET Beverage Bottles | 7,993 | 0.5% | $ 4,675,905 |
| PET Non-Bev. Bottles/Jars | 2,721 | 0.2% | $ 1,591,785 |
| HDPE Natural Bottles | 2,584 | 0.2% | $ 1,201,560 |
| HDPE Colored Bottles | 4,286 | 0.3% | |
| Other Plastic #3 - #7 Bottles | 2,601 | 0.2% | $ 507,195 |
| Food Polystyrene Foam | 6,530 | 0.4% | NV[3] |
| Other Polystyrene Foam | 3,830 | 0.3% | NV[3] |
| Other Rigid Plastic Packaging | 18,929 | 1.3% | $ 4,259,025 |
| Plastic Shopping Bags, Film | 6,025 | 0.4% | $ 903,750 |
| Plastic Industrial Film Pkg. | 1,455 | 0.1% | $ 218,250 |
| Agricultural Plastic Film | 526 | 0.0% | NV[3] |
| Other Plastic Film | 57,772 | 4.0% | $ 8,665,800 |
| Other Plastic | 27,844 | 1.9% | NV[3] |
| Composite/Other Plastic | 49,921 | 3.5% | NV[3] |
| **Total Residential Plastics Waste Stream** | **192,638** | **13.4%** | **$22,023,270** |

1. Mean of sorts, extrapolated to statewide waste stream
2. Assumes recovery of 75 percent of waste material, July, 2011 prices as reported by Moore Recycling Associates, Figure 2-14
3. No or nominal value

## 3.6 Use of Plastic Scrap as a Fuel Supplement

The DNR reports that more companies are attempting to capture film material, for example pallet wrap, to use in manufacture of fuel pellets for industrial and utility boilers. The material has a high BTU value and is clean. Use of these films as fuel binder for extruded fuel pellets is less likely to cause the user of the fuel to be classified as a waste incinerator. Ag films have been identified by Wisconsin MRFs and processors as being a particularly problematic plastic for conventional recycling, and thus a candidate for handling as a fuel resource. Use of these plastics in a pelleted fuel application is currently more cost-effective than cleaning them to the degree necessary for a "plastics-to-oil" or other fuel use.

## 3.7 Plastics to Oil

Despite increasing market applications for plastics recycling, there remains a significant portion of plastic wastes that cannot be mechanically recycled due to contamination, lack of markets, or the inability to separate different plastic resins. However, there are some conversion technologies emerging that are specifically designed to manage currently non-recyclable plastics, and commercial scale facilities are beginning operation in the US. The emerging technologies use pyrolysis to convert plastics into oil, fuel, or chemical feedstock.

The evolution of these conversion technologies gives rise to consideration of how these systems might serve as viable end of life options or how they might be used to complement the existing recycling infrastructure for plastics. A report commissioned by the American Chemistry Council in April, 2011 addressed the different technologies and current system vendors.[63]

The commercial scale facilities that are in operation in the US do not target recyclable resins that are currently marketed and do not pay for their supply. The technology is reported capable of handling all types of resins, but the business plans are based on zero cost for the supply. The product currently produced and marketed is crude oil to refineries. Potential feedstocks include plastics from a broad range of sources from municipal solid wastes, agricultural plastics, medical wastes, e-wastes, films, etc. Contaminants are reported to not be problematic, just not converted to oil.

A facility recently began operation in Minnesota with the private developer sorting plastics out of municipal solid waste, processing the mixed plastics, and producing crude oil. A facility for mixed, non-recyclables has been approved for Green Bay but is not yet in full scale operation.

# 4 Economic and Job Development

## 4.1 Introduction

There is significant potential for the plastics recycling industry to contribute to economic and jobs development in Wisconsin. The previous sections of this study have documented the strong indicators for continued growth in plastics recycling given the high value and high volume commodities that are still being disposed in Wisconsin landfills. This section of the study summarizes the existing federal, state and local level economic and market development programs that could be tapped to help accelerate this growth.

**Jobs creation potential**: National and other state studies have clearly shown the past growth and jobs creation potential from recycling systems. For example, plastics manufacturers using recycled resins employ over 200,000 workers throughout the U.S., second only to metals recycling in manufacturing industry employment.[64] To supply clean, sorted recyclables to these manufacturers, there are also a substantial number of jobs in the collection and processing of recyclables.

In all recycling systems, there is a progression in size of business establishments from recycling collection, through processing and up to manufacturing. Each of these sectors is an integral part of the larger supply chain where increasingly more value is added to the recovered material as it moves through the recycling system. Initially, a relatively small value is added by consolidation (i.e., collection). Processors such as MRFs impart significantly more value to the recyclable material by sorting and densification (e.g., baling). A critical step in plastics recycling is reclamation, where the material is further sorted, washed, ground into flake and/or pelletized. Reclaiming adds substantial value to the material. The greatest value is added in the manufacturing where the recycled commodities are made into useful new products.

The 2001 National Recycling Coalition (NRC) study researched the jobs and economic benefits of recycling. The NRC study looked at 26 different materials or recycling/reuse categories and examined the jobs in each of the components of the recycling system including, collection, processing and manufacturing. Specific to the plastics recycling industry, the researchers analyzed the jobs and economic development created by two types of plastics markets: reclaimers and converters. The NRC study defined plastic reclaimers as those companies that transform recovered plastics directly into intermediate products (e.g., plastic lumber) or raw materials (e.g., clean pellets or granulated flake) ready for remanufacture by other companies. Reclaiming activities include: separating, washing, grinding, flaking and/or pelletizing. Plastic converters convert recycled plastic flake or pellets into an intermediate (e.g., plastic sheet) or end products (e.g., packaging, other containers, pipe, fiber carpet or clothing). Table 4-1 displays the U.S. estimates from this 2001 study by market type.

## Table 4-1
## Economic Impact of Plastics Recycling Markets in the U.S. in 2001

| | Reclaimers | Converters |
|---|---|---|
| Number of Establishments | 780 | 2,510 |
| Employment | 19,411 | 178,700 |
| Annual Payroll | $557,989,000 | $5,354,547,000 |
| Estimated Receipts | $1,635,183,000 | $27,951,145,000 |
| Estimated Throughput (tons per year) | 2,581,000 | 2,581,000 |

Source: NRC *"U.S. Recycling Economic Information Study"* (July 2001)

The NRC research found that for every plastics recycling reclaimer, about 25 jobs are created with average annual receipts of about $2 million per year. These reclaimer jobs pay an average of about $29,000 per year. Plastics converters employ an average of 71 workers per establishment, with average annual receipts of about $11 million per year and an average salary of about $30,000 per year. (Note: pay estimates are from 2001)

**Challenges to new business establishment**: Even in the positive business climate of the mid 90's, the U.S. Small Business Administration (SBA) found that over 50 percent of small businesses fail in the first year and 95 percent fail within the first five years.[65] Start-up capital can be difficult for new companies to obtain; over 50 percent of the applications by entrepreneurs to SBA-affiliated banks are rejected.

Although recycling is a well-established business sector, there are still challenges, most specifically, to new recycling based businesses. Recycling is often seen by lenders as ephemeral or dependent on fickle citizenry for funding and participation. Conventional lenders hesitate to fund recycling-based manufacturing because, in their view, it involves unproven technologies. Start-up companies have limited track records or assets to pledge to lenders, and with traditional lending requirements, do not qualify for conventional loans. Venture capital is often targeted to medical, biotechnology, information technology (IT), or other alternative technology start-ups that are viewed as more cutting-edge. It is also difficult for manufacturers that plan to depend on recycled content to "prove" that sufficient recycled supplies will be on hand to guarantee production schedules when they approach lenders for capital. Thus, adequate recyclable plastics supply assurance is both a barrier to planned growth and a major economic development tool.

**Payback potential from investment in recycling business:** There are many positive economic multiplier effects from recycling industries. As a general rule, recycling manufacturers pay their labor force more compared to other establishments in the supply chain because of their need for employees with high levels of skill and training. The nature of manufacturing places strong demand on supplier firms for materials, supplies and utilities. Investments in local recycling

collection and processing and public policies that encourage recycling also yield significant government tax revenues, since the capital invested results in higher property values, and the new jobs result in income tax revenue. Plastics recycling markets are best viewed within the broader context of the overall plastics industry. For example, in the U.S. as a whole, the NRC 2001 study documented 15,414 total plastics converters, but only about 16 percent (2,510) of these were estimated to be using recycled plastics.

According to the current *Forward Wisconsin* web page[66], the overall plastics industry in Wisconsin is vibrant with over 1,067 plastics firms. The Wisconsin plastics industry employs nearly 39,800 people. Within the U.S., Wisconsin is ranked 8th in plastics industry employment. The average wage of a plastics industry employee in Wisconsin is $40,400. The plastics industry's direct payroll is $1.6 billion. Plastics dependent industries add another $12.9 billion to the state's payroll. The significance of Wisconsin's prominence in the industry can be attributed in part to a business climate favorable to the growth and prosperity of business.[67]

Some states employ economic development tools specific to the recycling industry. For example, California recognizes that an estimated 20,000 jobs could be created in California's manufacturing sector, plus another 25,000 jobs in sorting and processing, and tens of thousands more in ancillary jobs if recycling processes could be encouraged in-state, instead of exporting the processing and manufacture of recyclables to other countries. The Recycling Market Development Zones (RMDZ) program combines recycling with economic development to fuel new businesses, expand existing ones, create jobs, and divert waste from landfills. This program provides attractive loans, technical assistance, and free product marketing to businesses that use materials from the waste stream to manufacture their products and are located in a zone. The zones cover roughly 88,000 square miles of California. The loan program requires the same types of security collateral as a conventional lender, but familiarity with the recycling industry enables CalRecycle, the recycling and market development agency for the State of California, to finance new, yet promising, recycling technologies.[68]

## 4.2 Federal Economic Development Programs

### 4.2.1 U.S. Small Business Administration (SBA)

The U.S. Small Business Administration (SBA) was created in 1953 as an independent agency of the federal government to aid, counsel, assist and protect the interests of small business concerns. The SBA helps Americans start, build and grow businesses. The SBA has an extensive network of field offices and partnerships with public and private organizations. (See Appendix 4-A for more details and contacts for SBA services in Wisconsin.)

### 4.2.2 U. S. Environmental Protection Agency (EPA)

The EPA in the past was active in development and promotion of recycled materials markets. Publications such as the various Business Planning Guides contain information on "Why and How to Start a Recycling-Based Manufacturing Enterprise" and "Writing Business Plans for Recycling Enterprises: Plastics, Glass or Rubber."[69] EPA also has some generic information on plastics recycling and product stewardship. U.S. EPA has delegated many of its regulatory and recycling-related functions to the state environmental agencies. Therefore, Wisconsin DNR is a private company's first stop for technical and regulatory assistance related to recycling project proposals.

### 4.2.3 The U.S. Department of Commerce

The U.S. Department of Commerce helps promote job creation, economic growth and sustainable development by working in partnership with businesses, universities, local communities and the labor force. The Department promotes policies that help grow businesses including science and technology programs to foster innovation with a focus on research and development. (See Appendix 4-B for more Department contact information, program details, and a link to a Department grants search engine.)

Sustainable Manufacturing Initiative (SMI) - The U.S. Department of Commerce's Manufacturing and Services Unit has created an interagency working group on sustainable manufacturing. Evidence has shown that firms incorporating both environmentally and economically sustainable manufacturing processes can gain competitive advantages in that they reap inherent cost savings by improving their energy efficiency, minimizing raw materials usage, etc.[70]

The National Institute of Standards and Technology - Manufacturing Extension Partnership (NIST MEP) - works with small and mid-sized U.S. manufacturers. The nationwide network provides a variety of services, from innovation strategies to process improvements to green manufacturing. MEP places innovations developed through research at federal laboratories, educational institutions and corporations directly in the hands of U.S. manufacturers. MEP centers its work on five critical areas: technology acceleration, supplier development, sustainability, workforce and continuous improvement.[71]

## 4.3 State Economic Development Programs

Many of the Federal programs cited above have state affiliates. In addition, Wisconsin is fortunate to have many state-sponsored economic development partners. Many of these could be important partners in expanding plastics recycling business opportunities in the state.

### 4.3.1 The Wisconsin Economic Development Corporation (WEDC)

The Wisconsin Economic Development Corporation (WEDC) is the state's lead economic development organization. The WEDC, a public-private corporation, nurtures business growth and job creation in Wisconsin by providing resources, technical support, and financial assistance to companies, partners and the communities they serve.

In early 2011, ch. 238[72], Wis. Stats., was passed designating WEDC as the lead economic development organization in the state and charging it with: (1) developing and implementing economic programs to provide business support, expertise, and financial assistance to companies that are investing and creating jobs in Wisconsin; (2) supporting new business start-ups and business expansion and growth in Wisconsin; and (3) developing and implementing any other programs related to economic development in Wisconsin.[73] WEDC has five operating Divisions summarized below. (For more information on WEDC's contacts and budget, see Appendix 4-C.)

The Economic and Community Development Division assists Wisconsin communities to enhance their vitality by undertaking public investments that contribute to overall community and economic development. The Division also makes investments in companies that are expanding operations in Wisconsin. Key partners include: the

Wisconsin Economic Development Association (WEDA), regional planning commissions, regional economic development organizations, county and municipal governments, "Main Street" programs, and workforce investment boards. WEDC has seven Regions and assigns regional account managers to help businesses find the specific economic development resources that will be the best fit for each type of business or stage of business growth.

The Entrepreneurship and Innovation Division helps through research, development, investment capital, and by providing an effective entrepreneurship support network. This division supports the *"Startup Wisconsin"* effort, which is a regional initiative to increase the breadth and depth of the entrepreneurial network across Wisconsin.

The Business and Industry Development Division advances targeted, high impact opportunities for business growth with business consortia and industry sectors. Key tools of the division include: *"Enterprise Zone"* designations, job tax credits, economic development loans and grants, workforce and other training funds, and state agency response teams.

The International Business Development Division helps increase the exports of Wisconsin goods, increasing foreign investment and expanding export assistance capacity in the State.

The Marketing and Public Affairs Division helps advance business growth by supporting policies and promoting Wisconsin as a business-friendly location. This division advances the branding and marketing of Wisconsin assets and promotes the use of Wisconsin's business support resources by creating a one-stop access to business support resources.

### 4.3.2 Wisconsin Business Development Finance Corporation (WBD)

The Wisconsin Business Development Finance Corporation (WBD), an affiliated organization of the federal Small Business Administration, was formed to assist small businesses in gaining access to capital in order to grow their businesses, provide job opportunities, and inspire their communities. A cornerstone WBD program is the delivery of the U.S. Small Business Administration's (SBA) 504 product. Sold nationwide exclusively by not-for-profit Certified Development Companies (CDC), the SBA 504 loan fulfills the U.S. SBA public policy objective to support small businesses and create jobs in local communities through long-term, fixed-rate financing. WBD also provides consulting and loan packaging services to banks and borrowers. This allows lenders access to other government sponsored lending programs without the investment in training. This program allows small businesses access to working capital and restructuring solutions. (See Appendix 4-F for more information about WBD's programs and contacts.)

### 4.3.3 The Wisconsin Department of Natural Resources (DNR)

The **Cooperative Environmental Assistance (CEA)** is a bureau the DNR and is one of several programs supporting seamless access to business information on the DNR Web site. CEA is a partner with many business oriented organizations such as the Wisconsin Economic Development Corporation, Wisconsin Sustainable Business Council, Wisconsin Environmental Initiative Northwest Manufacturing Outreach Center and Wisconsin Manufacturing Extension

Partnership. The business tab, accessible from any DNR web page contains access to various forms of information and resources of assistance in areas from requirements for managing specific environmental risks to the pursuit of sustainable practices. (http://dnr.wi.gov/)

DNR business sector specialists from several programs are tasked with creating business value that accomplishes environmental results. They and a dedicated cross program sector team for each of the 10 identified sectors work to address sector issues, create sector support initiatives, advocate for resolution of issues and problem solve issues for individual or multiple companies that have implications for the sector overall. When called upon the specialist and/or team may take a lead role in addressing business attraction, business develop and job creation opportunities. Sector specialists and their teams ensure that DNR does its part to reduce regulatory burden, improve competitive position, increase market access, enable growth potential and facilitate more profitable approaches. They will also pursue more and better ways to establish sustainability, recognize superior environmental performance, share sustainable practices, create the capacity in any business regardless of size to exceed regulatory minimums, and deliver regulatory flexibility.

The ***Green Tier Program*** invites businesses to become part of the ideal state for growing a green bottom line. The various tools within the Green Tier Law provide credible, creative ways to enable businesses, communities and organizations to be a powerful, sustainable force for environmental good, enhance productivity, cut costs and strengthen the health of local culture and community. Dynamic, forward thinking businesses and charter associations benefit from the ideas, ideals and advantages of being a Green Tier participant. Specific benefits of Green Tier participation include:

- Recognition for superior environmental performance.
- Deferred civil enforcement.
- Single point of contact at DNR.
- Improved agency relations.
- Use of the Green Tier logo.
- Opportunity to be a pioneer in regulatory reform.
- Potential for permit streamlining, modified monitoring requirements, alternative compliance methods, and more.
- Benefit your business, environment and community.

Examples of plastics-related companies that participate in the Green Tier program include *3M Cumberland, 3M Menomonie, Cortec Corporation, Federal Foam Technologies, Fredman Bag, Phillips Plastic Corporation, Plastic Ingenuity, Inc., Serigraph, Inc., TOSCA LTD, and WS Packaging Group, Inc.

The **Waste and Materials Management Program** encourages management of waste as a resource to help ensure a clean and healthy Wisconsin for future generations. Wisconsin's communities and businesses benefit from a more efficient economy and a cleaner environment when waste becomes a resource. WMMP published the Wisconsin Recycling Means Business publication profiling Wisconsin companies and nonprofits that benefit from recycling or recycled materials, and maintains the Wisconsin Business Recycling Toolkit, an online resource to assist businesses and other away-from-home facility managers as they plan and manage recycling

programs. The toolkit provides practical information and easy-to-use resources to help implement a successful recycling program.[74]

The **Wisconsin Sustainable Business Council (Council)** is an independent non-profit that serves businesses in the state who are interested in sustainability, "greening", corporate social responsibility or corporate citizenship. Working in partnership with the DNR, it offers a suite of options to businesses interested in sustainability. The focus is on educating Wisconsin businesses, facilitating information exchange, and supporting businesses that are interested in sustainability. The partnership provides a platform for bringing existing groups together, coordinating between the groups and building a united effort to brand the state as a hotbed for innovation, "clean tech", alternative energy and sustainability leadership. By working together, the DNR and the Council seek to create opportunities for businesses to learn from each other and to improve the business climate and the success of Wisconsin businesses.

The DNR and the Council mentor, recognize and support businesses with an interest in sustainability and proactively work across program boundaries to provide a suite of incentives and services to businesses interested in sustainability.

### 4.3.4 University of Wisconsin Extension - Solid and Hazardous Waste Education Center (SHWEC)

Wisconsin's Cooperative Extension, part of the University of Wisconsin System, includes the Community Natural Resources and Economic Development (CNRED) program. The CNRED program has an extensive network of specialists as well as CNRED extension agents in most Wisconsin counties. CNRED extension agents are the first line of support for community natural resource and economic development.[75]

CNRED also includes the Solid and Hazardous Waste Education Center (SHWEC). SHWEC's mission is to enhance Wisconsin's environment and economy by providing quality education, information and technical assistance to promote the sustainable use of natural resources. A number of SHWEC's programs are directly related to this study.

The Wisconsin Recycling Markets Directory (WRMD) provides information about outlets for recycling various materials in Wisconsin. Users can search the list of recyclers for various materials, view information about the recyclers and suggest additional recyclers to include in the listing. The recyclers in the WRMD generally work with large volumes of material. Company to company connections are encouraged.

The Business Materials Exchange is intended to facilitate the reuse of surplus or unwanted items or materials between businesses, institutions and organizations. Users of the site are able to post items that are available, but also post a request for items needed.[76]

The Sustainable Communities Capacity Center - The University of Wisconsin - Extension Sustainability Team established and maintains this program to provide resources for local governments, businesses, nonprofit organizations, and individuals interesting in building their capacity to engage in sustainable community development. While the program focuses on community-based sustainability efforts in Wisconsin, and eco-municipalities in particular, it also provides other resources in the areas of economic development, planning and land use, energy and climate change, agriculture and natural

resources, consumer choices, and community stories. The site's *"Tool Box"* provides additional resources related to community sustainability and economic development, including links to the federal Manufacturing Investment Tax Credit, the New Markets Tax Credit, Workforce Training Grants For High Growth And Emerging Industries, Brownfields Assessment, Cleanup, And Revolving Loans, Community Services Block Grants, and Green Jobs - Workforce Training Grants.[77]

## 4.4 Regional, Local and Non-Profit Economic Development Programs

The federal and state programs above have additional local partnerships and affiliations, making it very important for companies to seek out the local economic development authorities and Chambers of Commerce who are experts in leveraging all of the levels of economic assistance for a specific company's needs. Virtually every county, and most cities, have an economic development group, active Chambers of Commerce, SCORE (Service Corporation of Retired Executives) or other groups that provide important assistance to companies that are expanding, or starting, businesses. Regional entities are summarized below.

### 4.4.1 The Wisconsin Manufacturing Extension Partnership (WMEP)

WMEP enhances the success of Wisconsin's small to midsize manufacturers by providing expert and accessible services in the areas of growth and innovation, continuous improvement, training, export assistance, supply chain management and profitable sustainability. WMEP is a strong advocate for manufacturers in Wisconsin and supports Wisconsin manufacturing at a national level. WMEP serves manufacturers in Southeast Wisconsin.[78]

### 4.4.2 The Northwest Wisconsin Manufacturing Outreach Center (NWMOC)

NWMOC, located on the campus of UW-Stout, Wisconsin's Polytechnic University, offers on-site services by seasoned practitioners with expertise in manufacturing management. The NWMOC is part of UW-Stout's Discovery Center, which provides applied research to foster discovery and innovation-based solutions. The experts at NWMOC deliver integrated services to manufacturers in 33 northern and western Wisconsin counties.[79]

### 4.4.3 The Wisconsin Profitable Sustainability Initiative (PSI)

PSI was launched by the Wisconsin Department of Commerce (the predecessor to the current WEDC) and the WMEP to accelerate the adoption of sustainability strategies by small and midsize manufacturers. The goal of PSI, an affiliate of the federal NIST-MEP program, is to help manufacturers reduce costs, gain competitive advantage and minimize environmental impacts using a team of energy, environmental, and lean experts.

### 4.4.4 WasteCap Resource Solutions, Inc. (Formerly WasteCap Wisconsin)

WasteCap is a nonprofit, industry supported 501(c)(3) organization that provides waste reduction and recycling assistance to businesses. WasteCap assists and encourages companies to effectively drive costs out of their operations through improved solid waste management practices. Services are made possible through membership, sponsorship, and grants. WasteCap provides direct services to businesses to connect waste generators to reuse, recycling, and compost markets. A project of WasteCap, the Wisconsin's Buy Recycled Business Alliance is

committed to increasing the procurement of recycled content products through education and leadership by example.[80]

## 4.5 Government Bonds, Tax Credits and Deductions

### 4.5.1 Tax-exempt, industrial-revenue bonds

Tax-exempt, industrial-revenue bonds (IRB) are attractive financing options for small manufacturers looking to expand operations and upgrade facilities. Tax-exempt bonds are debt securities issued by a state or local government development agency on behalf of a private business. Once issued, tax-exempt bonds are sold in the open market or purchased by investors or financial institutions. Interest income earned by the bond purchaser is exempt from state and local taxes, which allows the lender to pass savings to the borrower in the form of lower interest rates.

Tax-exempt bonds are similar to conventional loans. Bonds are not grants. Borrowers have to pay back the bond's principal plus interest to the bond. Applicants have to demonstrate a strong business plan and project proposal, creditworthiness and strong financial statements. In addition, borrowers have to demonstrate how proposed projects will create jobs and positively impact the local economy. Unlike conventional loans, tax-exempt bonds typically offer longer-term financing at considerably lower rates than conventional financing allows. Typically, bonds are intended to fund projects over a million dollars, but smaller, mini-bonds may be issued. In addition, the costs associated with tax-exempt bonds tend to be much higher than conventional loans because the business has to pay its own legal costs.

Tax-exempt bonds are intended to create jobs and improve economic conditions in local areas. Businesses eligible for tax-exempt bonds include manufacturing businesses and non-profit organizations. Tax-exempt bonds of up to $10 million can be issued to finance up to 100% of an eligible project. Eligible uses of the funds include expanding facilities and purchasing new machinery and equipment. Tax-exempt, Industrial Revenue Bond (IRB) funds may not be used to refinance existing debt or for venture and working capital. Other special conditions and terms may vary depending on where the business is located.

### 4.5.2 Tax Credits, Tax Deductions and Business Incentives

The Wisconsin Department of Revenue lists several tax credits or deductions that may be of specific interest to businesses as they expand into plastics recycling industries.

> The Economic Development Tax Credit provides tax incentives to new or expanding businesses whose projects will affect distressed areas in Wisconsin.
>
> The Enterprise Zone Development Program promotes business start-up or expansion in area of Wisconsin that suffer from high unemployment, declining property values or other indicators of economic distress. The program offers tax credits for hiring disadvantaged workers, performing environmental remediation and other activities. The maximum amount of the tax credits per zone is $3 million.
>
> The Job Creation Deduction provides a subtraction from federal income based on the increase in the number of full-time employees that are employed in Wisconsin. The subtraction is equal to $2,000 or $4,000 per employee, with smaller businesses (gross receipts of $5 million or less) eligible for the higher amount.

The Jobs Tax Credit requires certification by the WEDC that the company is operating a business in Wisconsin, has a contract with the WEDC and is eligible to receive tax benefits. The credit is based on the amount of wages paid to eligible employees up to 10% of those wages and the costs for employee training.

The Relocated Business Tax Credit rewards a business that relocates to Wisconsin from another state, and is equal to the amount of income or franchise tax liability after applying other credits and deductions.

The Work Opportunity Tax Credit is a federal tax credit that provides an incentive for employers to hire persons in target groups which have faced significant barriers to employment. Employers can save up to $2,400 - $9,000 per new hire over a two year period, depending on the employee hired. Targeted groups include Veterans, Vocational Rehabilitation referrals, Food Stamp recipients, and TANF (Temporary Assistance to Needy Families) or AFDC (Aid to Families with Dependent Children) and others.

The following summarizes other business incentives provided by various state agencies

The Business Employees' Program (BEST) can provide applicants with tuition reimbursement grants to cover a portion of the cost of training employees. The program targets small businesses that are facing severe labor shortages which need to upgrade the skills of their workers.

The Customized Labor Training Fund provides training grants to businesses that implement new technology or production processes. Training that is not available from the Wisconsin Technical College System is eligible for up to fifty (50) per cent of the cost of customized training.

The Early Planning Grant Program provides assistance to entrepreneurs and small businesses in Wisconsin to obtain professional assistance in evaluating the feasibility of a business start-up or expansion.

Wisconsin's Major Economic Development Program offers low interest loans for business development projects that create a significant, positive, economic impact.

The On the Job Training Initiative can provide up to fifty (50) per cent of the salary and fringe expenses for up to ninety (90) days for a hired employee that is referred by the Division of Vocational Rehabilitation (DVR).

The Rural Economic Development Program provides assistance up to $30,000 for feasibility studies and professional assistance to rural businesses with fewer than twenty-five employees. Micro loans of up to $25,000 are available to businesses that have completed their feasibility evaluations, and may be used for working capital and the purchase of equipment.

The Technology Development Fund helps businesses finance Phase I product development research. Businesses that complete Phase I projects may receive Phase II product-commercialization funding.

## 4.6 Local or Regional Programs

A series of federal, state and local grants and loan programs, along with associated technical assistance, are available.

### 4.6.1 Community Development Block Grants (CDBG)

CDB grants are funded through federal programs for small cities, and provide grants to promote local job creation and retention. The local governments lend these funds to businesses for start-up, retention and expansion projects. The amount of funding depends on the number of jobs created.

### 4.6.2 Tax Increment Financing (TIF)

TIF is an important economic development tool which a city or village can use to designate an underdeveloped or blighted area within its boundaries that is targeted for improved property values. The community can purchase land to attract companies, or provide infrastructure (e.g., utilities such as water, sewer, clean power, etc.) to support a company or business enterprise. The costs are recovered by the community through future increases in property values.

### 4.6.3 Eco-Industrial Parks (EIPs)

An eco-industrial park (EIP) can be defined as "A community of manufacturing and service businesses located together on a common property. Member businesses seek enhanced environmental, economic, and social performance through collaboration in managing collective benefit that is greater than the sum of individual benefits each company would realize by only optimizing its individual performance."

The goal of an EIP is to improve the economic performance of the participating companies while minimizing their environmental impacts. Components of this approach include green design of park infrastructure and plants (new or retrofitted); cleaner production, pollution prevention; energy efficiency; and inter-company partnering.[81]

Practically, EIPs are often envisioned as a stimulus for economic diversification in the community or region where they are located. Anchor tenants, such as bio-based product manufacturers, electric generation plants, or waste-to-energy facilities, can attract complementary businesses as suppliers, recyclers, service providers, downstream users and other businesses that could benefit from eco-industrial strategies. An EIP may also be planned, designed, and built in such a way that it makes it easier for businesses to cooperate, and that result in more financially sound, environmentally friendly projects for the developer. EIPs can be developed as greenfield land projects, where the eco-industrial intent is present throughout the planning, design and site construction phases, or developed through retrofits and new strategies in existing industrial developments. Based on the concepts of industrial ecology, collaborative strategies not only include by-product synergy (i.e., recyclable materials exchanges), but can also take the form of wastewater cascading, shared logistics and shipping & receiving facilities, shared parking, green technology purchasing blocks, multi-partner green building retrofit, district

energy systems, and local education & resource centers. This is a systems approach to industrial and economic development theory in which designs, processes, and business activities are integrated to address multiple objectives in one location or "campus".

EIPs have not been universally successful. The most successful EIPs are those that either grow incrementally, with a successful business attracting companion businesses that likewise become successful, or that tailor their growth to attraction of expanding, successful businesses that take advantage of improved locations, where synergy can occur. Planned EIPs in several communities in the U.S. did not succeed. These include: Brownsville, Texas; Youngsville, North Carolina; and Eastville, Virginia. Several others received funding, were enthusiastically received by residents, Chambers of Commerce and development organizations, but ultimately did not attract tenants. (See Appendix 4-H for case studies and more details on EIPs.)

## 4.7 Other States' Supply Assurance Case Studies

There are several case studies of state or local governments providing incentives for companies to develop new recycling market capacity through various forms of supply assurance mechanisms coupled with financial assistance.

### 4.7.2 Canyon Plastics (Valencia, CA; 2012)

The State of California required a guarantee that a manufacturer located in California would use recyclable plastic collected from California. CalRecycle, the State's primary recycling and economic development authority, provided a $1.2 million loan to Canyon Plastics to help it relocate to a larger plant and finance equipment purchases. The loan requires that Canyon Plastics, a custom injection and blow molder, divert 582 tons of plastics annually from California landfills, in addition to the 506 tons it already diverts. Canyon Plastics has also committed to creating 36 to 42 more jobs in California; half again its current work force. This CalRecycle loan and associated supply requirements was authorized as part of a State law establishing a market development program, including recycle-market development-zones through which CalRecycle loans funds to eligible businesses and non-profits in designated zones.[82]

### 4.7.3 NRDC News-to-News Mill (South Bronx, NY; 1992)

This is a much older case study related to development of a news-to-news recycled paper mill in New Your City dates back to 1992. Allen Hershkowitz, a senior scientist with the Natural Resources Defense Council, proposed building a paper mill in the South Bronx. It would harvest the wastepaper (old newspapers, junk mail, office paper, etc.) collected within New York City each day, recycle it into newsprint using ecologically sound methods and sell the product to local consumers, notably newspapers. The plan was intended to address two objectives: create new jobs in the South Bronx; and develop new recycling market capacity as an outlet for City recyclable paper. To guarantee good relations with the plant's neighbors, Hershkowitz found a local sponsor in Banana Kelly, one of the community development corporations that had sprung up in the 70's. Determined to resuscitate urban brownfields, the paper company decided to redevelop the Harlem River Rail Yard. Hershkowitz found a receptive Swedish paper company, and with a corporate anchor secured, investment bankers came on board, as did construction companies and engineers. The Natural Resources Defense Council put up seed money and helped clear regulatory hurdles. A bevy of foundations gave predevelopment grants. The state offered loan guarantees and helped with cleanup costs, and the city's economic development arm provided expertise. On paper, it looked like a half-billion dollar enterprise was taking off. The

start-up company, however, ran into road blocks. Business support proved fickle: they were concerned that the social and ecological goals of the project would lessen profitability. The Swedish firm withdrew from the Bronx project to concentrate on European ventures and it was not possible to find another big paper company to take their place. Not only were overseas paper mills more profitable, higher investment profits were available outside the industry altogether, in tech stocks or hedge funds. Finally, after 1992, the supply of newsprint outran demand, so producers began consolidating; new plants were not being built.[83, 84]

In 1995, an Australian company built a recycling mill on Staten Island and won the right to process up to 50 percent of the City of New York's wastepaper. The Staten Island mill produced liner board (used, for example, for shoe boxes), not newsprint. Therefore, the new Staten Island liner board mill was not in direct competition with the South Bronx news-to-news project proposal. Nonetheless, the Australian company lobbied hard against any municipal deal for the South Bronx project, just in case one day the Staten Island project might want to expand its product or supply lines.

Hershkowitz, in evaluating how future projects might succeed, considered that the State of New York might expand its market development role, either building green projects as public works facilities or committing public capital as lead investor. Many private, virgin product industries (notably pulp and paper, petroleum and highway construction) are heavily subsidized by various levels of government and tax codes. Hershkowitz suggested that the nation should be transparent about public investment, and establish a federal development bank like, but better than, the Reconstruction Finance Corporation that underwrote much of the New Deal and World War II.

## 4.8 Directories and On-Line Materials Exchanges

One of the most common challenges for recyclable plastic suppliers is to have good, current information about who is buying their types of plastics. On the other end of the system, end-use manufacturers and reclaimers want to know who the suppliers are. Several national and Wisconsin-specific markets directories and on-line information services are available today to help bridge this key information / networking gap. The following are the current, major recyclable plastics market directories.

### 4.8.1 UW – Extension / SHWEC

The Wisconsin Recycling Markets Directory (WRMD) provides information about outlets for recycling various materials in Wisconsin. Users can search the list of recyclers for various materials, view information about the recyclers and suggest additional recyclers to include in the listing. The recyclers in the WRMD generally work with large volumes of material. Company to company connections are encouraged. [85]

SHWEC's *Business Material Exchange* is intended to facilitate the reuse of surplus or unwanted items or materials between businesses, institutions and organizations.[86] Users of the site are able to post items that are available, but also post a request for items they may be in need of. This *Business Material Exchange* is currently underutilized by Wisconsin businesses. There is a lack of awareness of the availably of the exchange, both by businesses that could benefit from finding a low-cost "home" for waste materials that they must pay to dispose of, and by businesses that could be finding materials to use in manufacturing processes.

A similar lack of awareness exists in the Wisconsin plastics industry. Manufacturers that use virgin resins may not be aware of recycled resins in State that could be used and at a lower cost. Recyclable plastics processing facilities in the State may not be aware of end-use manufacturing markets located in Wisconsin that could potentially be available if appropriate investments were made.

### 4.8.2 RecycleNet Corporation

RecycleNet Corporation publishes a series of online market directories and scrap exchange services.[87] These include:

Scrap pricing index which provides commodity price and market trend information for the recycling industry.[88]

Recycler's World which provides an online B2B portal to promote the trade of scrap, waste and by-products. The client base has expanded worldwide and a web of regional portals has evolved.[89] This service includes a specific recyclable plastics page on scrap plastics.[90] Recycler's World lists the following types of recyclable plastics markets:

- PET Recycling
- HDPE Recycling
- Vinyl Recycling
- LDPE Recycling
- PP Polypropylene Recycling
- PS Polystyrene Recycling
- Other Plastics Recycling
- Polyester Recycling
- Nylon Recycling
- Polyurethane Foam Recycling

### 4.8.3 Forward Wisconsin

Forward Wisconsin is an independent economic development organization fostering economic development in Wisconsin that provides resources for businesses looking to either open a new location or to expand an existing business in Wisconsin. Forward Wisconsin updates a directory list of Wisconsin Plastics Companies which are broken down by company and by SIC code.[91]

### 4.8.4 American Chemistry Council

The plastics industry under the leadership of the American Chemistry Council (ACC) has been proactive in trying to list markets for recyclable plastics as a means to help promote recycling of their products. Often a recyclable plastics material supplier simply needs a company name and contact.

The following directories are sponsored by the American Chemistry Council (ACC) and operated and maintained by Moore Recycling Associates.

PlasticsMarkets.org is intended to connect suppliers and buyers of all types of scrap plastic (from bales to post consumer resin). It's supported by the plastics industry and intended for use by the recycling industry in the United States and Canada. This site is NOT intended for the general public or household plastics.[92] PlasticsMarkets.org also provides scrap plastic pricing and trends data.[93]

PlasticFilmRecycling.org is an online directory intended to connect buyers or service providers with generators of film and bags.[94] This directory is dedicated to only the following types of film plastics:

- HDPE (RIC code #2)
- LDPE (RIC code #4)
- LLDPE (RIC code #4)

This organization provides the directory of plastic film markets[95] and tips on how generators should identify their recycling options[96]

(Note: This web site was formerly known as "PlasticBagRecycling.org" but will soon be rebranded with the new name and URL: "PlasticFilmRecycling.org" to reflect the broader mission of the organization.)

### 4.8.5 Association of Postconsumer Plastics Recyclers

The Association of Postconsumer Plastics Recyclers (APR) has a directory of buyers and sellers.[97] The APR *Buyers and Sellers List* is an outline of the material that is bought and sold by APR members, who represent 90 percent of the postconsumer plastics recycling processing capacity in North America. The list is updated annually for the benefit of APR members and interested parties. APR also publishes a companion *Buyers and Sellers Guide.*[98] APR is also working to develop the market for some of the harder to recycle, minority recyclable plastics. See their listings for the following specialty bales:

*Market List for Tubs and Lids* lists companies purchase material which meets the APR tubs and lids model bale specifications.[99]

*Market List for Bulky Rigids* lists the companies that purchase material which meets the APR bulky rigids model bale specifications.[100]

### 4.8.6 Chicago Board of Trade

There was a failed attempt by the Chicago Board of Trade (CBOT) to get into the on-line directory and recyclables trading / exchange business. The National Recycling Coalition (NRC) report published in August 2000 reviewed this case study.[101] CBOT closed its Recyclables Exchange for trading of recovered materials at the end of 1999 after operating the Exchange on the Internet for more than three years. The CBOT originally launched the Exchange in October 1995 as an electronic bulletin board accessible via computer modem, switching it to the Internet in the fall of 1996. The conclusions of the NRC report state:

1. Recycling needs spot markets, but can spot markets stand alone?
2. Recyclers may need one-site shopping, but do buyers?
3. Quality assurance procedures are critical for online trading.
4. Price transparency will emerge as online trading succeeds.
5. The preferable format for online trading remains an open question.
6. Online trading solutions for non-closed loop or low-priced materials are still problematic.
7. Futures markets for recovered materials may arrive online in the future, but derivatives trading online has already arrived.

# 5 Alternative Improvement Options

This section outlines options and scenarios for improving plastics recycling systems in Wisconsin. The options include both public and private sector alternatives.

## 5.1 Section Summary

Wisconsin has ample opportunities to improve plastics recycling systems. As a primary strategy, DNR could adopt a detailed plastics recycling implementation and action plan including four specific planning and organizing tasks:

- Establish ambitious plastic diversion planning targets (e.g., 100,000 tons) for the year 2020 together with interim goals (e.g., collecting all plastic bottles in the largest municipal curbside programs by the end of 2014; collection of plastic film/bags via retail store drop-off by the end of 2016).

- Form a Wisconsin plastics recycling council.

- Hire a temporary market development specialist.

- Initial outreach, organizing and public relations with the release of this study to get industry feedback.

- Feasibility studies on the development plastics recycling facilities to determine the scale, scope and potential economics of new operations to sort if not reclaim two types of plastics:
  - Mixed rigid plastic containers and bulky rigid materials; and
  - Plastic film/bags.

This study outlines three broad planning scenarios, each with varying levels of government intervention:

1. **Status Quo Scenario –** Defined as relying on prevailing trends to support growth in plastics recycling in Wisconsin without any significant changes or system interventions. This scenario represents an approach whereby the private sector grows its own plastics recycling systems without significant changes in current state policies, programs or plans. Examples of business-to-business initiatives that may develop under this scenario include continued and expanded trends towards:

   - Single-stream recycling by recycling collection service providers and MRFs.

   - Collection of all plastic bottles, all rigid plastic containers, or bulky rigid materials as driven by market demand.

   - Voluntary plastic bag drop-off bins at retail stores.

   - Use of automated sorting equipment at MRFs and PRFs.

- Industry standardization of recyclable plastic terms, definitions and bale quality specifications.

- Voluntary systems for design for recyclability.

- Voluntary recycling market quality standards systems such as APR's "fit for use" program to identify PCR quality specifications.

2. **Partnership-Oriented Scenario –** Defined as a series of planned, phased government initiatives to promote voluntary partnerships and increase private and public investments, including voluntary producer responsibility programs. This scenario assumes enhanced public education as a basis for other capital and operating improvements. Examples of new program initiatives could include initiatives to promote:

    - Phased increase in municipal curbside and drop-off program recycling programs to include:
        - Phase One: All plastic bottles by the end of 2014; and then
        - Phase Two: All rigid plastic containers by the end of 2016.

    - An enhanced plastic film and bag recycling program (e.g., further research to characterize current recyclable supplies and disposal systems; enhanced film/bag recycling system development such as the Flexible Film Recycling Group pilot programs).

    - Enhanced supply assurance mechanisms developed by both business-to-business and government initiatives.

    - Public-private partnerships that would enhance "away from home" recyclables collection systems.

    - Enhanced government procurement policies and actual purchase of recycled plastic products.

    - Feasibility study on the development of a plastics-to-oil (PTO) facility in Wisconsin to recover residual and other waste plastics that are not recyclable.

3. **Policy-Oriented Scenario –** Defined by significant changes in plastics management, policy and recycling systems, including potential legislative policies. Examples of potential legislative policies could include:

    - Deposits on selected beverage and food containers.

    - Extended producer responsibility mandates (e.g., funding requirements for improved plastics recycling infrastructure).

    - Additional disposal bans on more types of plastics (e.g., All rigid plastic containers or all plastic bottles).

- Sales bans (e.g., bans on plastic bags).

- Recycling service requirements (e.g., retail stores must provide bag recycling bins with a legitimate recycling contractor providing hauling/recycling services to the retail store).

- Additional landfill surcharges to generate program revenues and discourage disposal of recyclable materials.

**Note:** These types of legislated policy proposals could be triggered by lack of steady progress towards improved plastics recycling and diversion on a voluntary basis under a partnership-oriented intervention scenario.

These three planning scenarios are hypothetical for planning purposes. In reality, the future path forward may include elements of each. The order of scenarios outlined in this report is intentional to first describe the current system (i.e., status quo) as a base scenario, followed by partnership-oriented additional interventions (e.g., voluntary public-private partnerships), and then finally more aggressive approaches involving higher government actions (e.g., legislated policy).

The second, "partnership-oriented intervention" scenario is both ambitious and feasible. The risk of failure may be more manageable if each option is carefully planned with appropriate collaboration of public and private interests. The intention is to make significant improvements in plastics recycling systems under a "win-win-win" proposition of finding common ground that intentionally combines public and private investments. However, if adequate progress towards increased plastics recycling is not achieved under a partnership-oriented intervention scenario, the state could take a more aggressive approach including legislated policy.

The third, "policy-oriented" scenario has theoretically the highest pay-off in terms of recycling rates and jobs growth. But it is also the highest risk of failure due to potential alienation of special interest groups.

## 5.2 Barriers to Growth

The approaches outlined in this chapter are designed to overcome barriers to growth that, unless addressed, could limit future growth and accelerated market development. The most significant barriers include:

- **Lack of adequate supply** for new or expanded markets to make additional investments in plastics recycling reclamation or end-use manufacturing capacity. This is a central theme that quickly emerged and was echoed by all persons interviewed for this study. For many types of plastics, adequate infrastructure and end-use capacity is already in place. The study interviews and other sources of information indicate there is a significant need for much greater supply of clean, sorted recyclable plastics. The DNR's solid waste characterization studies clearly indicate the significant amounts and variety of

types of plastics that are still being disposed of as waste. If these materials were diverted for recycling (e.g., instead of landfilled), significant new supplies of recyclable plastics from Wisconsin would become available.

- **Lack of access to capital** to invest in new facilities, expansions and/or equipment upgrades. Recycling is still viewed by many financial institutions as a high risk venture. In addition, the uncertainty of feedstock volumes and the lack of long-term supply assurance is a barrier to traditional private loans.

- **Lack of resources** to implement new programs and address barriers, including:
  - Government staff at the state and local levels;
  - DNR or other state assistance to RUs to enhance performance and evaluation standards for "effective recycling programs";
  - Focused, coordinated industry expertise and engagement in policy development;
  - Confidence in existing markets to sustain any expansion to collect and process additional types of plastic; and
  - Capital to invest in reclamation facility expansions or new operations.

- **Duplication of effort by local communities due to the complexities of RU system.** As stated in section 3.1, as of 2011, there were 1,060 RUSs implementing individual recycling programs in Wisconsin. About 886, or about 84 percent of the total number, of the RUs have less than 5,000 residents, yet collect only about 23 percent of the total recyclables as reported by all RUs. This RU system has served the state well over the past 20 years, but attempts to improve local government program efficiencies through consolidation have not been successful.

- **The RU grants are not adequate, the state funding formula needs to be revised and there is uncertainty about its future.** The current DNR grants to RUs pay an average of about 17 percent of the costs for the recycling program operations. The formula is based on an administrative rule tied to program needs in the base year of 1999. The state formula discourages revenue sharing and other innovations to expand and improve cost-effectiveness of local recycling programs.[102] The political uncertainty of state funding also discourages local units of government to make long-term capital investments in system improvements (e.g., MRF upgrades to add automated plastics sorting equipment, etc.)

- **Lack of information about markets** for recyclable plastics. Many interviews indicated that there is a need to improve two-way information exchange about potential markets for recyclable plastics. Existing directories and materials exchange systems need to be improved and maintained to further address the needs of Wisconsin recyclable plastics suppliers.

- **Inadequate data management systems** to accurately estimate recycling rates. The data quality about the amount of recyclable plastic disposed of is significantly better than the data about the amount of plastic actually recycled, especially from industrial, commercial, and institutional (ICI) sources. The poor accuracy and precision of recycling data inhibits more advanced policy development.

- **Lack of enforcement** of existing disposal bans as established in the *Wisconsin Recycling Law*. The existing regulatory framework in Wisconsin has certain provisions that are not being enforced (e.g., implementation and monitoring of RUs compliance assurance plans; commercial and other away from home recycling opportunities; etc.).

- **Inconsistent technical terminology and specifications** about the various types of recyclable plastics to be included in collection systems, bales and quality of post-consumer resin (e.g., flake or pellets).

- **Mixed public messages** within instructions about how and what types of plastics to sort out for recycling. These mixed messages can lead to confusion and lack of trust by the residents and commercial establishments. The lack of consistency hurts recycling participation and material quality.

- **Uncoordinated announcements** about the various lists of additional plastics that are now collected by recycling service providers and some municipalities. It is common for competing interests to use plastics recycling as another means to market their overall services. While the competition and diversity of ideas and approaches is healthy for the marketplace, uncoordinated private announcements can and do result in mixed public messages.

## 5.3 Description of Options

These options focus on how to grow Wisconsin plastics recycling systems and also grow new business development in the state. Current and potential funding options are outlined with an emphasis on leveraging private investments. Planning, research and technical assistance options are outlined as a means to provide the education and information exchange needed to sustain a coordinated approach.

This subsection describes all of the specific, improvement options that have been developed throughout the course of this study. The options are presented in a logical sequence (numbered from #1 to #40) from the lowest level of policy intervention to the highest. The options within the plastics recycling implementation and action plan (options #1 through #5) are presented first because they form the foundation planning and organizing tasks for all three of the improvement scenarios.
These options are intended to provide a menu of choices for policymakers and business leaders to review and discuss. Not all of these options can or should be selected for further development and implementation at the same time. Selected improvement options will need more definition to develop detailed work plans and cost estimates. In many cases, the options describe or imply potential new or additional roles and responsibilities for the DNR, WEDC, RUs and other government agencies along with alternative means to secure partnerships with various industries and individual companies. Table 5-1, Description of Options, further itemizes implementation tactics and potential DNR roles and responsibilities for each option.

In subsection 5.4, the options are placed within the three larger planning scenarios to provide a framework for analyzing potential costs and system impacts. The scenarios can be considered as "packages" of options that, when bundled together, form comprehensive, alternative strategies for improving plastics recycling in Wisconsin.

### 5.3.1 Adopt a Plastics Recycling Implementation Plan, Including Initial Organizing Tasks

DNR could develop a formal plastics recycling implementation plan with more complete itemization of selected strategies and supporting resources. This plastics recycling implementation plan could be phased in over the next eight years through the year 2020. During that planning horizon, progress and performance benchmarks would be established to measure success.

This study itemizes 40 potential options for improvement. In the next phase of planning, there will be a need to further prioritize the options. After providing feedback and considering their own roles and responsibilities, other government and business partners could begin to allocate resources. The implementation and action plan could describe these public-private partnerships with specific recycling/diversion goals, more detailed job growth estimates, itemized project work plans, schedules and budgets.

Adoption of the implementation plan by DNR is recommended for June 1, 2013.

#### 5.3.1.1 Establish a New Plastics Management Policy Hierarchy (#1)

This plastics recycling implementation plan should mirror the overall state waste management hierarchy.[103] It could more accurately be described as a plastics resource management plan because it should address the full spectrum of options within the hierarchy of policies and strategies.

The strategies for management of plastics as a resource should follow current state policy priorities, in order of preference:

1. The reduction of the amount of plastics generated.
2. The reuse of plastics.
3. The recycling of plastics.
4. The recovery of oil from plastics (i.e., plastics to oil).
5. The intentional composting of biodegradable and/or compostable plastics.
6. The recovery of energy from plastics (i.e., waste to energy).
7. The land disposal of plastics.
8. The burning of plastics without energy recovery.

This study is intentionally focused on the third priority, the recycling of plastics. The proposed implementation and action plan should, however, address each of the other priorities listed above as a means to set context and understand the overall market dynamics for production, use, reuse, recycling , recovery and disposal of plastics that impact the value of secondary plastics in the recycling marketplace. For example, by studying further the feasibility of plastics to oil, the state can help define the best and most appropriate use for waste plastics that do not have immediate value for recycling.

The top three priorities should be given preference, reflecting current policies. Integrated resource management policies need to actualize this preference for highest and best use of the plastic resource as indicated, by today's market price for a commodity. Priorities one through six as listed above should all count towards any plastics diversion goal. Only land disposal and

burning without energy recovery should be defined as non-diversion (AKA "disposal") for purposes of the plastics implementation plan.

#### 5.3.1.2 Establish New Plastics Diversion "Planning Targets" (#2)

As a part of the plastics recycling plan, DNR could establish a schedule of "diversion rates and dates" for recycling specific types of plastics. For example, DNR could specify planning goals as growth benchmarks such as "The state of Wisconsin will divert from land disposal an **additional 100,000 tons per year of plastics by the year 2020**." This diversion planning target should include all forms of waste reduction, recycling and recovery (including alternative resource recovery technologies).

These proposed "diversion rates" are defined in this study as a percent of the estimated tonnage of recyclable plastics disposed of in 2009 as reported in Table 3-5. Appendices 5-A through 5-C shows the detailed assumptions in percent diversion and tons per year that could be diverted by the year 2020. These are planning goals for estimated **additional** tons of recyclable plastic diverted per year. These tables detail one scenario to achieve a total planning target of just over 100,000 tons per year of additional plastics reused, recycled or otherwise recovered by 2020. These planning targets in tons per year diverted (Appendix 5-C) indicate that about 64 percent of the additional recycling and recovery of plastics will come from the ICI sector. The largest category of plastics proposed to be targeted for diversion is film at 32 percent of the total, with 72 percent of the film tonnages coming from the ICI sector.

These are hypothetical targets or goals for planning purposes. They suggest a very ambitious program of plastics recycling growth coupled with an increase in alternative recovery options (e.g., waste to energy and plastics to oil) for the waste plastic items that have no or negative value. The vast majority of improvement options and suggested priorities in this study are focused on recycling strategies.

#### 5.3.1.3 Plan for Phased Increase in Municipal Collection of Plastics (#3)

By establishing planning goals, DNR will lead in developing a long-term framework for recyclable plastics collection, public education, processing and marketing. In addition to this longer-term planning target, DNR could also set shorter-term planning goals and strategies. For example, the state could establish the goal that all curbside programs should be collecting "All plastic bottles" by the end of 2014 and "All rigid containers" by the end of 2016. Curbside programs that meet the goal would retain state funding and "Acceptable program" status; those that do not would lose some or all of their state funding and/or not qualify for the exemption from existing landfill bans.

#### 5.3.1.4 Plan for Enhanced Plastic Film/Bag Recycling (#4)

This option is comprised of a comprehensive series of plastic film/bag recycling strategies. It could start with specific goals targeting plastic film/bags diversion (e.g., 32,000 tons diverted by 2020). Other interim targets could include strategies such as: "The 25 largest cities should all have viable drop-off recycling options at local retail stores by the end of 2014." This initiative to provide residents with film/bag recycling service would be coupled with a parallel program to enhance PE film collections from business establishments.

#### 5.3.1.5 Measure Progress Towards Goals (#5)

Several qualitative and quantitative methods could be used to measure annual progress towards goals. Qualitative measurements could include analysis of improved program delivery (e.g., new recycling services, collection of additional plastic materials, facility expansions, etc.). State, local and private investments in improvements in the plastic recycling infrastructure can be readily monitored and reported on an annual basis.

Quantitative measurement of annual progress towards numeric goals is more difficult and expensive but nonetheless feasible. Annual progress towards these diversion rate goals could be reasonably estimated by conducting regular solid waste composition analyses similar to the 2009 *Wisconsin State-Wide Waste Characterization Study*. For example, such composition studies could be conducted every two years with extrapolated estimates used for the off years.

Cost savings and enhanced data collection methodologies should be proposed in any scope of work for these proposed composition analyses. For example, the methodology for the analyses could include:

- **Improved definition of categories** for recyclable plastics. Standard plastics recycling industry definitions should be proposed for future waste composition analyses.

- **Add characterization of recyclables as collected** so that corresponding data (and categories) of recyclable materials can be included in the overall analyses. Often called a "capture rate" study, this method includes intentional, side-by-side sampling of trash and recycling streams from the same waste generators.

If such improved methodologies designed and implemented, DNR may be able to enhance the planning goals to a more direct set of targets such as recycling rates or recycling tonnages by type of plastic. There are additional cost efficiencies that have been used in other characterization studies.

Other measurements should include continued reporting by RUs and MRFs. The DNR reporting systems could be improved by standardizing the terminology and definitions for the various types of plastics. Materials delivered (inputs) to MRFs could be distinguished from products (outputs) so as to better understand the materials flows and value added by sorting, baling and other processing efforts by the MRFs. Residential vs. commercial tonnages should be estimated on a more standardized basis. Commercial recyclable plastics that, in the past, have not been reported could be estimated through voluntary (or mandatory) surveys. Recyclable plastics markets (i.e., reclaimers and end-use manufacturers) located in Wisconsin could also be surveyed. While the survey of Wisconsin markets will not capture the recyclable plastic materials marketed outside of Wisconsin, this survey will help document the growth of supply from within the state.

Adequate reporting and data management is a key barrier to the growth of plastics recycling market development. There are many alternative means to incentivize new or improved reporting. One alternative is to simply pay the MRFs, commercial establishments, and markets for their reporting efforts, or to adjust license fees commensurate with quality of reporting.

### 5.3.2 Staffing, Organizing and Communications/PR

#### 5.3.2.1 Hire a Market Development Specialist (#6)

DNR could hire a full time market development specialist to coordinate the planning and implementation of enhancements to the state's recycling programs, including plastics recycling. There is a clear and present need for additional resources at DNR to focus on the specific opportunities for growth in plastics recycling identified in this study. This position could be temporary as a limited term employee (LTE) status or on a specific project assignment basis. (Note: a portion of this position could be allocated towards the proposed 2013 plastic film/bag pilot project. See option #14, section 5.3.4.4, for more details on this project.)

This market development specialist may address multiple other commodities, but plastics recycling should be the first priority given the momentum generated from this study. This specialist should be tasked with interagency coordination on plastics recycling with other organizations such as SWHEC, WEDC, WMEP, and NWMOC, to name just a few.

#### 5.3.2.2 Establish a Wisconsin Plastics Recycling Council (#7)

This study found very positive and widespread support for cooperative plastics recycling market development improvements. There is unanimous recognition of the untapped value of these potentially recyclable items that are currently being disposed as waste instead of recycled as a resource. There is a clear need to build on the results of this study into a next phase of planning and public-private coordination.

One option to leverage the potential for public – private partnerships is to form a Wisconsin plastics recycling council. This new council should be made up of government and corporate representatives involved with the plastics recycling in Wisconsin. One objective of this council should be to help direct the plastics recycling implementation plan, including advice on program priorities and funding sources. Another explicit objective should be to develop, guide, coordinate and monitor state planning, R&D and program investments.

The council members should be expected to lead and implement, not simply advise on policy. Members should be solicited that have a proven track record of improving plastics recycling systems, both public and private, through modern innovations and creative market development.

An informal preliminary steering committee could further develop the details for this council including membership, mission, staffing and level of authority as an element of the plastics recycling implementation plan. This council could initially be convened by staff of DNR, but the charge could be broader to include advice to other state agencies and organizations.

#### 5.3.2.2 Conduct Initial Outreach, Organizing and Public Relations (#8)

DNR could develop a set of strategies for initial industry outreach, organizing and public relations as part of the release of this study. Ideas that have been discussed include:

- **Convening a half-day forum** to solicit industry feedback and bring together the principal staff of key state agencies and the economic development organizations such as WEDC, WMEP and NWMOC. This forum could provide a simple, visible opportunity for broad-based input on the policy options.

- **Developing a DNR web page** dedicated to plastics recycling, including the release of this study and the details of feedback opportunities (including the forum). Any new plastics recycling implementation and action plan adopted by DNR could also be added to this web page. DNR may wish to construct a feature on this web page to allow for feedback comments from readers and users of the information as an additional means to encourage ongoing dialogue within the Wisconsin plastics recycling industry.

- **News release** to announce the completion of this study, the key findings, and opportunities for continued feedback and participation (including the forum and web page).

- **Sending hard copies of the executive summary** to each of the individuals and organizations that helped through interviews or case studies for this report. The DNR cover letter should provide additional details about how interested parties can comment, offer feedback and continue to stay involved in future planning and next step actions. (Note: When the interviews were conducted, the project team committed to proactively sending out the report in this manner.)

### 5.3.3 Feasibility Studies

There is a present need to conduct detailed feasibility studies on two types of plastics recycling facilities (PRFs):

- Rigids PRFs
- Film PRFs

#### 5.3.3.1 **Conduct a Rigids PRF Feasibility Study** (#9)

The development of a rigids plastics recycling facility feasibility study could determine the scale, scope and potential economics of a new operation to sort and reclaim mixed rigid plastic containers and bulky rigid materials. MRFs often produce mixed plastic bales that, in many cases, are exported to foreign markets (e.g., in China, etc.). It may be feasible for a rigids PRF to open and positively sort these bales of mixed plastics into single resin categories of the more valuable materials (e.g., non-bottle PET containers, non-bottle HDPE containers, PP bottles, etc.). Depending on scale / volume of material, a rigids PRF may be able to use automated sorting equipment for the largest volume products. The negatively sorted materials remaining at the end of the sort line could then be re-baled and exported, used in a waste to energy facility, or used in a plastic to oil facility.

The feasibility study should look at the relative costs and scale of operations needed, given current and forecasted future market demand. The feasibility study could include a "mixed bale" characterization study to further refine the estimates of plastic material types and volumes.

#### 5.3.3.2 **Conduct a Film PRF Feasibility Study** (#10)

Similar to the concept of a rigids PRF feasibility study, the development of a film PRF feasibility study could determine the scale, scope and potential economics of a new operation to sort and reclaim mixed rigid plastic containers and bulky rigid materials. The feasibility study should

look at the relative costs and scale of operations needed given current and forecasted future market demand, and transportation systems to move material from commercial and industrial staging points to the PRFs. The feasibility study could include a film characterization study to further refine the estimates of plastic material types and volumes.

### 5.3.4 Enhance Collection and Processing

It is important to plan now for enhanced collection and processing of additional volumes of plastics, if not types of plastics. This study finds that a coordinated, planned approach may leverage industry investments and thereby enhance public – private partnerships as collection and processing systems are expanded and improved.

The following study findings can be used to design new plastics recycling collection and processing enhancements:

1. Public education, outreach and standardization of messages are key elements throughout.

2. Single stream collection will increase tonnages, but increase costs of sorting at the MRFs and may adversely impact plastic bale quality.

3. Automated sorting technologies will continue to make inroads, improving sorting efficiency.

4. Existing entities will most likely be effective to make these collection and processing enhancements without the need for new legislation.

5. Continued implementation of the Wisconsin disposal bans can be used strategically by type of plastic to leverage industry engagement. Removing waivers on specific plastics will provide assurance to entrepreneurs and processors that their facility investments will have recyclable materials to process.

#### 5.3.4.1 Expand Single Stream Recycling Systems (#11)

Single stream recycling programs have increased throughout Wisconsin. The use of automated collection trucks and single stream recycling carts has reduced collection costs and made the opportunities to recycle more convenient for residents.

The single stream carts are usually in the size range of 65-gallons or 95-gallons. However, collection frequency most often changes to every other week (26 collections per year) rather than weekly (52 collections per year) when single stream recycling is implemented. Even with the decrease in collection frequency there is usually a net gain in recycling container capacity when collection changes from curbside recycling "bins" to single stream "carts".

For plastic recycling, the added cart capacity of single stream systems is a definite advantage. Even though the volume of other, minority plastic containers (i.e., beyond PET and HDPE bottles) is relatively small, the flexibility of the cart allows capacity for more types of plastics to be collected within existing curbside programs without additional costs. The inclusion of bulky rigids will need to be planned and tested more carefully, since they do not fit inside the carts, and reduce the efficiency and cost-effectiveness of the single stream system. The City of Madison

has added additional types of plastics to their curbside programs, at little cost beyond educating their residents.

The bigger concern in expansion of plastic types in curbside collection programs is the MRF sorting and processing design and capacity. Many of the larger private MRFs have already made line modifications and equipment upgrades (e.g., automated sorting equipment) to handle a larger and more diverse stream of recyclable plastics. But most of the smaller, public MRFs are still handling only PET and HDPE bottles. The cost, funding sources and market capacity questions that the RUs asked as part of the study interviews must be thoroughly and adequately addressed before any disposal bans or added plastics recycling requirements should become effective. Public MRFs interviewed expressed reluctance to include other plastics without market reliability. Local governments investing in increased plastics processing capacity need assurances the end markets will be around for the long-term. Their strategy of producing high quality bales of positively sorted PET and HDPE bottles is a sound business approach that has resulted in highly cost-effective programs. . On the other hand, there is a need to stay current with private companies and to satisfy the desires of residential and commercial recycling customers that want additional plastics recycling services beyond PET and HDPE bottles.

As MRFs convert to single stream, or upgrade for other reasons (e.g., combining into a regional, multi-county system), the long-range future of plastics recycling should be carefully considered in the plant modifications. For example, the plastics industry has more than adequate demand to absorb the non-bottle PET and HDPE containers. Sorting, storage and marketing systems should be planned and designed for at least these types of plastics, if not "all bottles" or even "all containers." DNR should anticipate and answer these MRF upgrade design questions as clearly as possible within the plastics recycling plan (e.g., anticipated sequence of adding new types of plastics to the sort lines). DNR could even develop a targeted technical assistance program (possibly through a contractor) to address the specific, customized needs of each public MRF making such upgrades.

Designing upgrades to MRFs should emphasize enhancing quality of the plastic bales. Taking on additional types of plastics can have a detrimental effect on bale quality. Recyclable plastic products should be positively sorted whenever possible, whether manually or via automated sorting machines.

This study found that collecting plastic film/bags in curbside collection is much less feasible than expanding and enhancing the retail drop-off programs for these materials. However, the MRFs may be able to use the same markets and benefit from the enhanced film/bag recycling infrastructure for film plastics that are inadvertently collected.

#### 5.3.4.2 Enhance Away From Home Recycling Systems (#12)

Section 3.2 of this study summarized current away from home recycling activities. Section 5.1.5.1 above discussed options for increased enforcement of disposal bans at away from home venues. A focus on non-residential recycling services is appropriate at this stage of Wisconsin's recycling program. Like most other parts of the country, away from home recycling has only recently become a priority.

Best practices for away from home plastic recycling systems would involve:

- Recycling bins "paired with" each trash bin. (i.e., make recycling as convenient as disposal.) Many cities and park systems have used 55 gallon drums (plastic or metal) that are converted to "recycling bins" to obtain customized, cost-effective containers. When the containers are "adopted" by local businesses, schools or neighborhoods they are ideal canvasses for unique messaging that, in turn, builds local pride and increased recycling in the area.

- Signage attached to the recycling bins. The content should include, but not be limited to, clear messaging of the list of acceptable plastics. (The preference would be to include standardized photos to the extent possible so as to communicate program instructions without the need to translate into other languages.)

- Adequate collection service to prevent overflowing recycling bins. This can be most cost-effective by using simple, very thin recycling bin liners that can be tied off when the bin gets full. Thus, a recycling service provider's truck can simply load up the pile of bagged plastics or commingled recyclables (if the program is single or dual-stream and the materials are not presorted as part of collection).

- Incentivize a new system to enhance private investments (e.g., producers/manufacturers) in these improved recyclables collection systems. These private investments can be either encouraged or mandated (or both) as described in later subsections.

Wisconsin's Interstate highway rest stops are both a model of best practices collection systems and a concern for service trends and administrative efficiencies. DNR could request assistance from Wisconsin Department of Transportation (WisDOT) to conduct a brief review of current recycling systems and suggest potential improvements. Upgraded data management and reporting may help improve systems controls, including accountability for the materials recycled. The WisDOT rest stop recycling system may be able to increase recycling rates by assuring that all recyclables are indeed recycled. Also, there may be improved container / bin systems available.

Park and recreation facilities generally need to have upgraded recycling service opportunities. In some cases, (e.g., at state parks) the facility owners have decided that no trash and recycling service is better than upgraded service levels. The design philosophy in these examples is to encourage (if not require by default) the park user to "pack it in / pack it out" by carrying their trash and recyclables home with them in their own person vehicles. There is a need to better understand how participants at these "no service" facilities actually perform in terms of compliance with proper trash disposal and recycling behaviors. DNR could conduct further research on park facilities to determine if the "no service" option is the most effective recycling solution.

Sporting Facilities have made some very notable attempts to recycle plastic bottles and cups. National plastic container manufacturers' trade organizations (e.g., NAPCOR) have produced technical assistance toolkits to help sporting facilities and events learn how to best recycle plastics at these stadiums and events and leagues such as the NFL are highlighting recycling efforts this season. DNR could examine and then reference these toolkits to help other sporting facilities in Wisconsin, and could leverage team pride to develop competition between the sports

venues for most effective recycling programs. Use of after the event "recycling picks" as a part of normal trash / litter clean-ups could be considered in addition to dedicated recycling bins.

Convenience stores and gas stations are prime opportunities to reinforce the recycling message. Convenience stores with recycling containers capture between 2,000 to 3,000 pounds per year of container recyclables, of which 75% are PET bottles. Recyclables captured reduce the business' waste disposal fees, and results in customer appreciation of the effort. Minnesota's Message in a Bottle™ program is one model

Other public spaces include a wide variety of other government buildings and facilities including: schools, libraries, bus stops, airports, train stations, and city right-of-way boulevards in downtown districts. The same best practices principles should apply for recycling at these facilities. DNR should require RUs to help their local agencies upgrade their away from home recycling opportunities at such other public facilities.

#### 5.3.4.3 Increase Use of Automated Sorting Equipment (#13)

Section 2.5 described the state-of-the-art for automated plastics sorting equipment. These advancements in technology greatly enhance the cost effectiveness and overall profitability of plastics recycling systems. DNR (or the Wisconsin plastics recycling entity described in section 5.3.10.1) could look at a program (e.g., grant or low-interest loan) specifically targeting the need for the smaller, public MRFs to install such sorting equipment. The industries that will purchase the sorted product could partner with the MRFs to fund the automated sorting equipment, in exchange for contracts for the product. This results in assured, competitive markets for the MRFs and assured, competitive sourcing for the industries. WEDC may also be able to use one or more of their financial assistance programs to help fund automated sorting equipment.

The Carton Council is a group of carton manufacturers formed to help local communities and recyclers divert cartons from the landfill. The Carton Council has a MRF assistance program that may be a viable model for the plastics industry. The Carton Council has financed the addition automated sorting equipment needed at MRFs to positively sort cartons in return for an agreement that the MRF will collect and market cartons for recycling.

#### 5.3.4.4 Enhance Plastic Bag and Film Recycling (#14)

Based on the 2009 DNR *State-Wide Solid Waste Characterization Study*, plastic film, including bags, makes up the largest category of plastics disposed of at about 234,000 tons per year. This landfilled material has an approximate value of more than $7 million per year (see Section 3.5 and Tables 3-6 and 3-7). The individual types of film include:

| | |
|---|---|
| ♦ Plastic shopping bags, film: | 5,000 tons per year |
| ♦ Plastic industrial film packaging: | 8,000 tons per year |
| ♦ Agricultural plastic film: | 2,000 tons per year |
| ♦ Other plastic film: | 17,000 tons per year |
| **Total plastic film/bags diverted:** | **32,000 tons per year** |

(Source: 2009 DNR *State-Wide Solid Waste Characterization Study*.
Line items do not add up to total due to rounding.)

The potential options for improving plastic film/bag recycling range from partnership-oriented forms of intervention to more intensive legislative mandates and include:

- Standardized public education on plastic film/bag reuse.
- Other forms of plastic film/bag reduction.
- Encouraging or requiring retailers to provide recycling drop-off bins (e.g., service opportunities for customers).
- Encouraging or requiring residents to source separate and recycle plastic film and bags.
- Labeling standards and/or requirements for bag manufacturers.
- Design for recyclability (DFR) standards and/or requirements for manufacturers.
- Recycled content goals and/or mandated rates.
- Government and non-profit purchasing of recycled plastic products (e.g., environmental preferable purchasing) such as: recycled lumber; transportation/highway materials; office supplies; carpeting; other fiber products.
- Disposal bans.
- Bag bans (i.e., sales bans).

*"GreenBlue,"* a nonprofit organization that that equips business with the science and resources to make products more sustainable, sponsors a program[104], the Sustainable Packaging Coalition (SPC), to help promote appropriate recycling labeling messages on consumer packaging. SPC developed a label to help more accurately reflect the recyclability of plastic bags and film. SPC created a special version of its label for plastic bags and films that are accepted primarily at retail stores that use plastic bags.[105]

PlasticBagRecycling.org and the Flexible Film Recycling Group (FFRG) of ACC are seeking candidate states and/or regions of the country to pilot test their new plastic bag recycling public education program. This education program is centered around providing clear and simple instructions for residents to recycle a variety of plastic bags that are typically generated in households. Figure 5-1 displays the poster that serves as the anchor graphic and public education tool for this new program.

## Figure 5-1
## PlasicBagRecycling.org's
## Residential Plastic Bag Recycling Poster


Source: [www.PlasticBagRecycling.org](http://www.PlasticBagRecycling.org)

FFRG and PlasticBagRecycling.org are informally seeking states and/or regions to pilot the new public education program. On August 27, 2012, DNR submitted a preliminary proposal to FFRG to be one of the pilot areas. DNR proposed that Wisconsin be a pilot for both the new SPC label and the public education program in the stores. This proposal is preliminary, but has received favorable reviews by FFRG to date. A more formal proposal and complete scope of work will need to demonstrate how DNR could build-out a network of service providers handling recyclable film and plastic bags. For example, the goal of this DNR film/bag recycling initiative could be for the largest 25 cities in Wisconsin to have viable film/bag recycling services by 2014.

One barrier to the expansion of film/bag recycling services is that small and medium sized business establishments do not have their own fleet of trucks or storage space for recycling of film and bags. One resolution is to work with the network of recyclers that already recycle old corrugated cardboard (OCC) from those same businesses. The businesses would bale film/bag plastic in the same, small, vertical OCC balers and then piggyback the new collection of film/bag bales on the OCC bales. In addition to multi-use of balers, there is a need to enhance reverse logistics and backhaul options for the small/medium businesses.

DNR could develop a strategic plan in early 2013 specifically for film/bag recycling. This film/bag recycling plan could include:

1. The 2014 goal for the largest 25 cities in Wisconsin to have film/bag recycling service;

2. A plan for reverse logistics / backhaul operations;

3. Consideration of business-to-business (B2B) recycling services whereby a smaller business (e.g., small neighborhood grocers) will deliver film/bags to a larger retailer (e.g., a large chain). (See case study as documented by PlasticBagRecycling.org[106]);

4. Compile a list of at least three large wholesale distributors in Wisconsin who are interested in establishing a network to collect and backhaul recyclable plastic bags and wraps from customers;

5. Perform additional research on the types, amounts and quality of the "Other plastic film" as identified in DNR's 2009 *state-Wide Solid Waste Characterization Study*; and

6. Develop recommendations for legislative authority to implement various EPR initiatives if specific performance benchmarks (e.g., the goal in #1 above) are not met.

### 5.3.5 Enhance Technical Assistance to RUs, MRFs and Other Suppliers

There is a need for to provide an enhanced level and quality of technical assistance and guidance to counties, municipalities and businesses involved with the collection and processing of recyclable plastics generated from Wisconsin communities. This technical assistance program could be coordinated through the plastics recycling council and using priorities outlined in the implementation and action plan. The program could initially target the existing RUs, MRFs and other suppliers for enhancing collections of rigid plastics materials and private retailers for plastic film/bags.

It is possible this could be conducted by a Wisconsin – based affiliate of a national organization (e.g., ACC, APR). Another alternative is that this technical assistance work could be conducted by the conceptual Wisconsin plastics recycling corporation described in section 5.3.10.1. As a last resort, DNR could provide this technical assistance, but the relative cost and effectiveness may not be the same compared to an industry-funded organization with a higher stake in the outcomes.

#### 5.3.5.1 Promote Standardized Plastics Recycling Definitions and Bale Specifications (#15)

Due to the wide variety of plastic types and sources and the relatively young plastics recycling infrastructure, there are few widely used standard terms and definitions. This lack of standardized terminology is a major barrier inhibiting the growth of the plastics recycling industry. Sections 2.4.1 and 2.4.2 of this report identify recent initiatives by the plastics recycling industry to develop standard terminology and specifications for various types and bales of recyclable plastics, especially the emerging materials beyond PET and HDPE bottles.

DNR should embrace, reference, and adopt industry standard terms and bale specifications as a framework for its own set of guidelines to RUs, MRFs and other suppliers. The adoption by DNR of industry terminology and bale specifications should be qualified as guidance only, not mandated requirements. Local suppliers and individual businesses will have their own variations on these definitions and bale specifications, but the industry standards can provide an essential base reference point for such variations.

APR has developed model bale specifications for:

- PET bottles [107]
- PET thermoform containers [108]
- HDPE bottles [109]
- Tubs and lids [110]
- Bulky rigids [111]

Each of APR's bale specification documents include a disclaimer stating that these model bale specifications published by APR are not meant to replace the specifications of individual buyers, many of whom may have different "allowables" in terms of contents and bale sizes. Rather, these model specifications are meant to provide a benchmark and incentive to suppliers. For example, PET bottle bales produced to the model APR bale specification will be well accepted by APR members, with potential price preference.

Recycling of plastic bags and polyethylene (PE) film is not available everywhere in Wisconsin. However, many retail stores and some municipal drop-offs in the United States collect plastic bags and polyethylene film for recycling. Sections 2.4.2 and 3.1.2 in this study discuss the national and Wisconsin status of plastic film and bag recycling efforts.

The web page, PlasticBagRecycling.org, lists sample buyer specifications for bales of plastic bags.[112] These are examples of buyer specifications and quality standards that may be required of suppliers. The following types of plastic bags and film are listed as examples:

- HDPE grocery bags (postconsumer)…. "Bales must contain at least 70 percent HDPE grocery bags …. with less than 30 percent LDPE bags and shrink film"

- LLDPE stretch film …. "Bales must contain at least 96 percent stretch film …. with less than two percent HDPE bags; less than two percent colored film"

- LDPE bags …. "clear LDPE bags only; Stretch film and bubble wrap can be mixed"

Striving for contaminant free bales improves the value of the material and increases a supplier's market options.

DNR could publish a reference sheet of standard terms, definitions and specifications for use by the Wisconsin plastics recycling community.

#### 5.3.5.2 Promote Standardized Public Education Outreach Messaging (#16)

This study has documented the wide variety of public education messages about what is recyclable plastic. RUs, private collectors and MRFs have each developed their own set of markets that accept and/or buy different grades and types of recyclable plastics. These suppliers have, in turn, often developed their own unique terms for describing the various plastic items that are "acceptable" and "not acceptable."

Section 2.10 presents and discusses the use of ASTM resin identification codes (RIC) for identifying various types of plastics. The original intent of these codes and the label on bottles and other containers was to help with resin identification and training of MRF sorters. Since then, a variety of interests have used the codes as part of public education and outreach tools to

instruct users about what is or is not recyclable. The use of the RIC for public education has recently become controversial. APR initiated[113,114] and then soon withdrew[115] a campaign to promote plastics recycling public education (e.g., as part of residential curbside programs) without the use of the RIC numbers.

One local education program in the Twin Cities region produced by the Solid Waste Management Coordinating Board (SWMCB), states:

> *The small number enclosed by the "chasing arrows" symbol on the bottom of a container is called a "resin code" and indicates the general category of plastic it's made from, not whether or not it can be recycled."*[116]

DNR could play a lead role in developing a long-term framework for recyclable plastics collection and public education. For example, as stated in Section 5.1.1, DNR could set a planning target goal of all curbside programs collecting "All plastics bottles" by the year 2014 and "All rigid containers" by the year 2016. If these kinds of planning goals are established, DNR could also provide standardized guidance documents on how best to describe these recyclable plastics along with "camera-ready" clip-art for RUs and private collectors to use in promoting these categories of plastics.

This standardized public education and outreach messaging could be demonstrated by the proposed Flexible Film Recycling Group (FFRG) pilot projects. One element of the national FFRG campaign is to label plastic bags with a standardize emblem about recyclability. The Sustainable Packaging Coalition (SPC) has developed a standard series of labels to help promote appropriate recycling labeling messages on consumer packaging including plastic film and bags. Another element of the FFRG campaign is to develop model plastic bag and film collection systems. DNR has applied to become one of the regional pilots and there has been a positive preliminary response from FFRG. This initiative focused on plastic film/bags could help lead the way on similar standardization for public education and outreach on rigid plastics. (See section 5.3.8.4 for more discussion about the FFRG campaign, pilots and the SPC labeling program.)

#### 5.3.5.3 Enhance and Promote Existing Recyclable Materials Directories and Exchanges (#17)

This strategy is a means to facilitate transactions and longer-term relationships between sellers of recyclable materials (e.g., collectors, MRFs, etc.) and buyers (e.g., plastics reclaimers, end-use manufacturers, etc.). Section 4.7 described the current market directories and material exchange systems that exist today. One remaining question is what level of information and markets data sharing is needed by both buyers and sellers. This study suggests that the existing information and recyclable plastics markets directories and on-line services may be adequate, but need to be more widely disseminated. DNR could summarize the available plastics markets information sources (similar to the summary in Section 4.7, including web lines and phone numbers), distribute this to all RUs and MRFs serving Wisconsin communities and post it on the DNR plastics recycling web page. DNR could also work with UW-Extension's SHWEC to upgrade the *Wisconsin Recycling Markets Directory* for recyclable plastics markets by adding new listings (see Appendix 3-P) and dividing the "markets" (reclaimers and end-use manufacturers) from the organizations that are "MRFs and Other Plastic Handlers" (see Appendix 3-Q).

SHWEC could also provide more information about the form or quality of the materials accepted by the markets, and provide periodic updates of the information.

#### 5.3.5.4 Promote Enhanced Away From Home Recycling Systems (#18)

This option is the state and private technical assistance component of option #12 (section 5.3.4.2). This technical assistance is needed to make the potential improvements a reality.

### 5.3.6 Enhance Financing, Supply Assurance and Siting

#### 5.3.6.1 Leverage Existing Financial Assistance (#19)

A major cornerstone for moving selected options forward is how to best leverage existing Wisconsin and local financial assistance and jobs development programs (See Section 4 for more details on these programs). As part of the plastics implementation plan, detailed work plans and cost estimates could be developed by DNR staff, in cooperation with other state and private interests, for selected improvement options. These detailed work plans could also identify the best funding sources and other partners. DNR could continue to solicit the assistance and cooperation of WEDC as the lead economic and jobs development authority in the state. WEDC could advise and direct the best means to finance selected plastics recycling market development options. These financing plans could then become a key part of the detailed work plans.

WEDC uses a three-tiered, "pyramid" framework for financial assistance for eligible companies expanding or locating into Wisconsin. The bottom or base of the pyramid is bonding authority and has the largest budget. The second tier is tax credit programs. Businesses can get tax credits for job creation, expansion, capital investments, or training. There are six different tax credit programs. The third tier at the top of pyramid is the smallest dollar amount and includes cash and loan programs. This third tier includes loan guarantees, cash loans and gap funding. The third tier also includes grant programs for workforce development. WEDC should continue to partner with DNR to find opportunities to focus these financial assistance programs on the most viable of the plastics recycling market development initiatives.

#### 5.3.6.2 Provide Additional Targeted Financial Assistance to Markets (#20)

Wisconsin could consider expanding its role in plastics recycling market development to include providing seed funding for R&D or capital costs. The state could impose various conditions for any such grant or loan program including:

- The facility must be located in Wisconsin and stay in Wisconsin for the life of the agreement.
- A majority of the feedstock of recyclable plastic or recycled resin must be collected or processed from Wisconsin.
- Potential buyers of the recycled plastic resin (e.g., end-use manufacturers) or products that are located in Wisconsin must be given rights of first refusal.

Sourcing recyclable plastics and/or recycled resin from in-state processors will reduce the feedstock transportation and procurement costs for Wisconsin markets. Enhancing supply assurance while collapsing the geographic supply shed should result in a competitive advantage to Wisconsin plastics markets. This could potentially lead to increased market share and accelerated growth of Wisconsin businesses. WMEP and NWORC both have business-oriented,

real-world R & D programs that pair the research and problem-solving capabilities of their facilities with entrepreneurial Wisconsin businesses. There is a wealth of imagination and expertise to be shared if pathways could be cleared between the resources and the needs.

#### 5.3.6.3 Enhance Supply Assurance Mechanisms (#21)

Supply assurance is a market development strategy that provides a guaranteed supply of recyclable plastic or recycled resin to a plastic reclaimer or manufacturer. The legal structure for supply assurance varies and can include:

- Long-term contracts.
- A competitive sales and marketing plan based more on month-to-month, "spot market" buy-sell arrangements. These competitive feedstock procurement plans are the most common form of supply assurance used in the plastics recycling industry today and are based on current market prices, quality of service to suppliers and business relationships.
- Vertical integration by a processor or manufacturer into recyclables collection or processing (e.g., MRF or PRF).
- Other forms of feedstock incentives or project financing requirements.

Supply assurance is a general building block component for any new waste recovery or recycling project that requires a minimum amount of specified throughput to economically survive. In solid waste resource recovery projects (e.g., mixed solid waste to energy facilities), supply assurance planning can include a series of state-of-the-art mechanisms to provide adequate volumes of feedstock including: waste designation (AKA "flow control"); contracts; open competition for feedstock procurement; landfill bans; and other forms of subsidies or landfill surcharges. Often a resource recovery project will utilize a combination of these types of supply assurance mechanisms rather than rely on just one method.

This study finds that the lack of adequate supply assurance for clean, recyclable plastics or recycled resin is a key barrier to growth of plastic recycling markets in Wisconsin. If companies could be assured of supply, they could then make investments in expanded or new plastics reclamation or manufacturing capacity. Local assured supply, in turn, will give them competitive advantages in the global market place.

#### 5.3.6.4 Promote Eco-Industrial Parks (#22)

Section 4.6.3 described the concept of Eco-Industrial Parks (EIPs) as an additional tool to help promote plastics recycling market development. The EIP concept should be explored further by DNR and WEDC for purposes of statewide economic and job development. In the end, however, it is local and regional partner agencies that will need to lead and coordinate the development of any EIP. WEDC and DNR should continue initial discussions about this EIP option with the larger cities (e.g., Madison, Milwaukee) and counties in Wisconsin. Local EIP projects may be able to attract federal grant funds (see Section 4.2 for more details on federal programs).

### 5.3.7 Promote Development of Domestic Market Capacity (Especially in Wisconsin)

There is a need to look at opportunities for marketing recyclable plastics to both domestic and export markets. China has been a major influence on the global demand for recyclable plastics for over two decades (see Section 2.8). Export demand is expected to decline as China develops

its own internal sources of recyclable plastics and as domestic markets mature. Recognizing this changing dynamic, DNR should not exclude export markets as a current strategy to stimulate further recyclables collection programs. Rather, DNR could look at exports as a current, additional buffer for materials with currently limited infrastructure in the U.S.

DNR should develop policy preferences for selling recyclable plastics first to Wisconsin buyers and then domestic buyers whenever possible. The state may be able to include such preferences, if not outright requirements, in any financial assistance packages that are developed to help grow plastics recycling in Wisconsin.

#### 5.3.7.1 Develop New Plastics Sorting and Reclamation Capacity in Wisconsin (#23)

This study finds that Wisconsin needs additional recyclable plastics sorting and reclamation capacity to assist existing businesses to be competitive. For some plastics (e.g., PET and HDPE bottles), there is adequate capacity in Wisconsin or the U.S. or Canada to handle a double or tripling in volumes, especially if the increases are planned and coordinated. However, sorting capacity for the other types of recyclable plastics, especially from "mixed" bales, is less developed. DNR could explore how to develop this sorting capacity.

One alternative scenario is for DNR to release a request for expression of interests (RFEI) for sorting and/or reclamation capacity for mixed non-bottle rigid plastic. If such an RFEI were planned and released in cooperation with WEDC, one of the questions that could be addressed is "How could the state best help finance and support such a facility?" Another question that could be addressed is "What state-imposed conditions would the private companies be willing to accept on the market destinations for the sorted and/or reclaimed products?" For example, "Would the respondents to an RFEI be willing to accept a condition that Wisconsin manufacturers are given first rights to buy the recycled pellets or flake?"

#### 5.3.7.2 Promote APR's "Fit for Use" Initiative (#24)

APR is currently developing a "Fit for Use" initiative that could facilitate the reclaimer ←→ manufacturer information exchange about specifications for recycled resins. Manufacturers need to be able to accept a recycled resin that is different than that of virgin resin. Yet, it has been difficult for manufacturers to actually put this tolerance into a written material quality specification. It will be very helpful for the recycled plastic suppliers to know the broadest possible specifications manufacturers can tolerate in terms of color, melt flow, density, size of flake/pellet, etc. Also, once these parameters are published, it will be helpful for manufacturers to provide ballpark estimates on the amounts of material produced to this specification that they could utilize.

Reclaimers, on the other hand, know that they can adjust their processes to improve recycled resin quality, but each improvement comes with added costs. The APR "Fit for Use" initiative is intended to help bridge that information gap between manufacturer and reclaimer to the point of developing agreed-upon written specifications. APR is still in the process of developing draft "Fit for Use" specifications and hopes to release a public draft for further comment in the near future. Once the specifications are available, DNR could release these documents further to other Wisconsin plastic companies for review and comment. Companies in Wisconsin that have proved to be leaders in sourcing Wisconsin recycled materials could be approached to be pilot companies in the program. In addition, DNR could undertake the gathering of Wisconsin-

specific "Fit for Use" data to encourage the use of postconsumer resins in-state and provide reclaimers and potential investors the unrealized demand for recycled plastic.

#### 5.3.7.3 Promote Recycled Content Policies (#25)

There are a number of options that have been tried by state governments in the past to stimulate end-use demand for recycled products. The following outlines some of the more common examples:

- Government purchase of recycled products, either directly by various agencies (e.g., parks departments buying recycled lumber) or through purchasing cooperatives.
- Listing of recycled products in government published directories.
- Mandate minimum recycled content in selected products that are sold in the state.

#### 5.3.7.4 Promote "Buy Recycled" (#26)

DNR could develop its own purchasing preferences for plastic products made from recycled materials, especially for products made with materials sourced from Wisconsin. This DNR – led example should then pave the way for future preferences for such recycled product purchases by all state and local agencies that receive state funding.

DNR could develop legislative proposals that require recycled content. For example, policies could be developed that:

- Plastic bags sold in the state must have a 25 percent post-consumer recycled content.
- Parks must use recycled content plastic lumber.
- Non-food rigid plastic packaging must have 10 percent post-consumer recycled content.

### 5.3.8 Develop Other Voluntary Producer Responsibility (VPR) Options

There are several voluntary producer responsibility (VPR) concepts that could be explored to help improve plastics recycling in Wisconsin. Below are just two of those options.

#### 5.3.8.1 Form a Wisconsin Plastics Recycling Corporation (#27)

An entirely private, Wisconsin plastics recycling organization may be needed to significantly accelerate the market development of plastics recycling. The concept of a public-private Wisconsin plastics recycling council discussed in section 5.3.1.8 may be a valid approach to help direct and coordinate the work of DNR and other Wisconsin agencies and organizations. But an entirely private corporation (probably structured as a non-profit) may be needed to actually invest in the infrastructure and provide the necessary level of technical assistance to suppliers.

One concept is to form a plastics recycling corporation similar to the Carton Council for aseptic packaging. The Carton Council:

- Has an aggressive/assertive market development program.
- Pays a guaranteed price for collected aseptic packaging.
- Arranges for markets (qualifies selected mills as markets).
- Pays for holding bins at MRFs that have very low volume or infrequent shipments.
- Provides public education PR grants (e.g., $9,000 to county for educating residents).

These are valid examples of potential services, but there may be a different set of priorities and project assignments to the Wisconsin plastics recycling corporation.

#### 5.3.8.2 Promote Reverse Vending Machines (#28)

PepsiCo, Keep America Beautiful, and Waste Management partnered to develop and roll out the *Dream Machine* program launched in April 2010, designed to increase the U.S. beverage container recycling rate from 34 percent to 50 percent by 2018. The *Dream Machines* are reverse vending machines that allow the general public to insert their plastic PET bottles and receive a coupon for store credits. The *Dream Machines* are provided by WM GreenOps, LLC, a subsidiary of Waste Management and operated by *Greenopolis*. The intent of the system is to bring together on-street technology for redeeming plastic bottles with online technology for registering for the program and receiving store credits. DNR should monitor this type of voluntary PET bottle redemption program and request tonnage and other performance data to help document its effectiveness in recycling plastic bottles.

#### 5.3.8.3 Promote Design for Recyclability (#29)

Design for recyclability (DFR) is a general recycling industry initiative to improve product design through careful consideration and planning of end-of-life disassembly and recycling. The guiding principle of any packaging design must be fitness of purpose. Beyond this, designing to enhance recyclability should be in the forefront of design considerations. For the plastics bottle and rigid container manufacturing industry, APR has developed its *Design for Recyclability™ Guidelines*.[117] Such DFR guidelines are not yet available for the non-bottle household containers (e.g., thin-walled tubs, cups, etc.) and plastic film and bags, but these guidelines are under development by APR. DNR could help disseminate these DFR guidelines, monitor these voluntary producer responsibility efforts and encourage further industry compliance.

Alternatively, the state could consider legislation that amends the Wisconsin plastics labeling law to require compliance with the DFR guidelines. If a manufacturer does not follow the guidelines, state law could prohibit the use of the RIC chasing arrows symbols on any product sales in the state.

The state could also use its comprehensive plastics recycling authority to promote the consolidation of resins used in food and beverage packaging. For example, the use of PVC in bottles has declined over the years and there are no known domestic markets for PVC bottles. Therefore, the entities in the state could not collect or recycle these containers.

Other, higher levels of intervention to promote accelerated resin consolidation include (but are not limited to):

- Prohibiting the use of the RIC code emblem (i.e., chasing arrows in a triangle).
- Other forms of sales bans.

### 5.3.9 Develop Alternative Recovery Technologies

Emerging technologies have recently been introduced into the solid waste management and recycling industries to recover the energy value or constituent petroleum elements of plastics.

Technologies such as pyrolysis, gasification and "plastics to oil" (PTO) have begun to target both the mixed waste stream and mixed waste plastics as feedstocks. Wisconsin statutes and DNR regulations define waste to energy as separate from recycling. Incineration is considered disposal under the disposal bans in the Recycling Law.

These emerging technologies are not the primary focus of this study. However, these systems are common in Europe and are emerging in the U.S. for plastics that are not conducive to recycling, and offer a way to recover something of value from plastics for which the only current option is disposal in a landfill. The adjacent end use market for recovering energy from plastics through such systems needs to be discussed and implications for recycling and public education understood.

#### 5.3.9.1 Develop Waste to Energy (#30)

Section 3.6 discussed the current use of waste materials such as plastics as a fuel supplement. This option needs to continue as a viable policy strategy and to help supplement higher value forms of recycling plastics. For materials with no to negative value (e.g., mixed with regular trash) waste to energy (WTE) could continue to remain a viable diversion outlet in communities where such facilities and solid waste plans allow.

One of the related options is to pelletize waste plastics (e.g., ag film) for use as a fuel supplement. Some farmers are already pelletizing waste plastics that do not have paying markets. This may be an option that has potential for growth assuming feedstock materials and boiler operations can be adequately controlled to address air quality concerns. Similarly, a large amount of waste wood is currently being landfilled, that could be recovered and combined with non-recyclables plastics into a high BTU fuel pellet. The synergy of removing these energy-bearing materials from land disposal and using them in-state for energy recovery has positive potential for increasing competitiveness of Wisconsin businesses.

#### 5.3.9.2 Plastics to Oil (#31)

Section 3.7 discussed the current status of the plastics to oil (PTO) emerging technology in the U.S., including one operation in Minnesota. Like WTE, this option needs to continue as a viable policy strategy and to help supplement higher value forms of recycling plastics. For materials with no value (e.g., mixed with regular trash) PTO could continue to remain a viable diversion outlet in communities. DNR could further discuss the concept of a PTO facility co-located with a plastics recycling facility (PRF) (e.g., as per the Eco-Industrial Park concept discussed in Section 5.1.4.2. The PTO facility could immediately receive and convert the waste plastics (without recycling value) from the PRF into an oil product creating synergy by proximate locations. DNR could also commission a feasibility study on a PTO facility to determine the scope, scale and economics of such a venture.

### 5.3.10 Enhance the Disposal Bans

Section 1.3 of this study summarized Wisconsin's *Recycling Law* including the recyclable material disposal bans. These bans could be a much more effective tool in promoting increased recycling when coupled with other forms of improved systems for collection, processing and marketing. The bans cannot and should not be considered as stand-alone strategies for supply or market development. The entire list of public and private recycling program services and

policies need to be considered together as a package and not evaluated in isolation as individual options.

#### 5.3.10.1 Enhance Enforcement of Existing Disposal Bans (#32)

There has been a lack of adequate state and local oversight and enforcement of certain provisions of the current bans. While residential recycling programs have grown steadily over the past two decades, the non-residential recycling programs are still very underdeveloped. There is a large share of "away-from-home" PET bottles disposed of, yet DNR still deems the RUs as having "effective recycling programs" (see Section 5.1.6.2 below for more discussion of away-from-home options.) There are still over 17,000 tons of PET bottles and nearly 6,000 tons of HDPE bottles disposed of today in Wisconsin.

DNR could announce as part of a new plastics recycling plan that it will begin to enforce these other provisions of the *Recycling Law*. Partnership with the beverage industry, recycling as a marketing tool, and lowered waste disposal costs when the recyclables are removed from disposal have paid for separate recyclables collection in several instances.

The plastics recycling plan should be adopted only after careful consideration of comments solicited from RUs and plastics industry interests. Elements of DNR's plastics recycling plan should include:

- An enhanced compliance assurance plan in which RUs propose by July 1, 2013 how they will work with their local commercial establishments and other public agencies to upgrade the away-from-home recycling services for banned materials.

- Standards for "adequate plastics recycling service" at away-from-home venues. For example, trash cans would ideally be paired with a recycling bin for plastic bottles, perhaps paid for by producers.

- Reference materials, tool kits and other technical assistance guidance on best practices for away-from-home recycling services.

- Discounted pricing on recycling bins through grants, loans, cooperative purchases and corporate sponsor advertising on the sides of the bins.

- A specific schedule of increased state oversight and industry self-monitoring of "adequate" recycling services under the new standards.

- Enforce the bans by developing more detailed performance standards and goals.

#### 5.3.10.2 Expand Disposal Bans to Include Additional Plastics (#33)

The existing disposal bans have a series of waivers as authorized by DNR administrative rules. This option suggests that DNR should intentionally rescind the waivers on a planned and deliberate schedule. The plastics recycling plan should include specific criteria for its determination of "adequate markets." These criteria include:

- Four or more total buyers (with significant capacity) for a specific type of recyclable plastic.

- Adequate capacity to handle the projected amounts of that type of recyclable plastic collected from Wisconsin.

- At least one market located in or near Wisconsin.

- At least a two-year history of successful purchase, recycling and significant use of specified types of recyclable plastic.

The recycling plan should include a specific schedule for review, consideration and implementation of additional disposal bans. For example, this schedule could include the following effective dates for additional disposal bans:

| | |
|---|---|
| Non-bottle, rigid containers made from PET (e.g., thermoforms, clamshells, etc.) | December 31, 2014 |
| Non-bottle, rigid containers made from HDPE (e.g., tubs, lids, cups, etc.) | December 31, 2014 |
| All bottles | December 31, 2014 |
| All rigid containers and attachments made from PP (e.g., food bottles and containers, lids, caps, etc.) | December 31, 2016 |
| Bulky rigid materials (e.g., buckets, plastic toys, furniture, etc.) | December 31, 2016 |
| Bags and other film made from PE (e.g., grocery bags and other residential film bags) | December 31, 2014 |
| All other recyclable plastic containers | December 31, 2018 |
| All film from ICI sources (other than "dirty film" from agriculture) | December 31, 2016 |
| All other agriculture film | December 31, 2018 |

### 5.3.11 Propose New Mandatory Options

A series of other mandatory extended producer responsibility options are available to the state. These mandatory options would require new legislation. These options are presented in this Section of the study without consideration of political feasibility. Policy assumptions are implied to optimize the best case technical and economic outcomes for each option.

#### 5.3.11.1 Consider Container Deposits (#34)

Container deposit systems are defined, described and briefly analyzed in Section 2.6. It should be noted that container deposits are the only proven and viable policy instrument to increase plastics recycling for those containers to the levels targeted in this study. Container deposits are a known system and the only impediment to a deposit law in Wisconsin is political.

The state could enact a container deposit system for Wisconsin that:

- Specifies the legislative intent to include the following objectives:
  - Maximize recycling rates;
  - Enhance plastics and other recyclables market development;
  - Enhance economic development through new supplies of recyclable materials; and
  - Increase Wisconsin jobs.

- Covers the broadest spectrum of container types possible. For example, the state could consider extending the proposed deposit system to a wider variety of plastic containers than traditional deposit programs, including:
  - Beverage bottles (as per traditional state deposit programs);
  - Other non-beverage bottles; and
  - Other non-bottle rigid containers.

- Specifies that unredeemed deposits remain with a third party non-profit (such as a Wisconsin recycling corporation) to help fund targeted enhancements and expansions of the recyclable plastics infrastructure including financing such strategies as:
  - Automated sorting machines;
  - Direct payments to MRFs that can document a net loss in revenue due to the deposit system; and
  - Enhanced data management and reporting systems.

- Specifies integration of the new deposit container materials handling system into the existing infrastructure of municipal curbside, drop-off and processing systems. This could include strategies such as:
  - Co-location of the new container deposit redemptions operations with existing and enhanced unpaid (donated) drop-off facilities;
  - Redemption by container weight (i.e., cents per pound) in addition to per container unit (i.e., cents per container);
  - Co-processing and co-marketing of deposit and non-deposit containers; and
  - Preference for existing MRFs to be certified as the container deposit processors and redemption centers.

The state could wait until there have been at least two additional waste composition analyses to determine if adequate annual progress is being made to recycle the targeted containers under a voluntary system. MRF reports on the amount of recyclable materials handled will also help supplement the information gained in the waste composition studies. In addition, the state could use qualitative program and recycling service levels standards as a secondary means of measuring annual progress towards the goals.

#### 5.3.11.2 Consider Extended Producer Responsibility Mandates (#35)

DNR and other interests could consider a number of mandated requirements for plastic packaging and film manufacturers, producers, and distributors. These could include options such as mandating that such producers:

- Take direct responsibility for the end-of-life management for their products either by providing recycling opportunities (e.g., "take back" / reverse logistics systems) or funding a third party system that provides for these opportunities.

- Design their plastic packages or other items in manner that optimizes the customer's ability to recycle those packages/items.

- Follow the industry standards for labeling plastics (e.g., ASTM's RIC system; SPC; etc.).

One example in Wisconsin of an EPR program is the new electronic waste recycling law. E-Cycle Wisconsin is a statewide, manufacturer-funded program that recycles certain electronics used in homes and schools. E-Cycle Wisconsin takes a product stewardship approach to electronics recycling.

Each year, manufacturers of products covered by Wisconsin's electronics recycling law must pay for electronics to be recycled. This funding makes it easier for individuals and schools to recycle old electronics. The E-Cycle Wisconsin program is supported by Wisconsin's electronics recycling law (2009 Wisconsin Act 50[118]), which bans electronics such as TVs, computers and cell phones from Wisconsin landfills and incinerators.

#### 5.3.11.3 Consider Additional Landfill Surcharges (#36)

Landfill surcharges are state or local taxes placed on the tipping fees at landfills. Wisconsin already has a form of landfill surcharge that helps to pay for some of the costs of recycling and other programs. Part of the effect of such surcharges is to raise the cost of disposal to make recycling more competitive from a financial cost standpoint. Also, this helps raise revenue to pay for the costs of program implementation.

DNR could use the planning targets (Section 5.1.1), with interim benchmark triggers, to suggest that additional funds may be needed to meet these targets. For example, if the diversion rates are not being met by 2015, DNR could request the landfill surcharges be increased and that the increased funding be appropriated to plastics recycling programs.

As an alternative, DNR could request that more of the existing landfill surcharge funds be allocated to assist with these types of recycling program improvements, instead of being diverted to other state agencies and programs, or that the programs receiving the diverted funds must use them to enhance recycling business development.

#### 5.3.11.4 Consider Advance Disposal Fees (#37)

An advance disposal fee (ADF) is a fee levied on the distribution or sale of a specific product. The fee may be designed to achieve any or all of the three following goals:

- Generate revenue to fund waste prevention, recycling and related environmental programs;

- Discourage consumer purchase of hard-to-dispose products or disposable products for which cost-competitive, more durable alternatives are readily available; and

- Encourage manufacturers to eliminate and/or reduce packaging, and/or increase the recycled content and/or recyclability of targeted products and/or packaging. In other jurisdictions, ADF's have been levied on a variety of items including oil, tires, white goods, and packaging.

Plastic packaging, including film, is prolific and a significant component of waste originating in Wisconsin. Through imposition of an ADF on plastic packaging, the state could generate revenue for waste prevention, recycling and other solid waste management programs. Material – specific ADFs could be considered if adequate annual progress is not made towards significant improvements in recycling and other forms of recovery (e.g., waste to energy and plastics to oil). One variation would allow an exemption from ADF requirements if the specific plastic material meets minimum post-consumer recycled content requirements (e.g., 25 percent PCR).

#### 5.3.11.5 Consider Sales Bans (#38)

Federal, state and local governments have used the policy of sales bans of a wide variety of materials (e.g., toxic and hazardous substances; cigarette and liquor sales to minors) to achieve goals with broad consensus. For packaging materials, such sales bans may be a legislated means to promote public health, effect solid waste policy, reduce waste generation, and encourage recycling. Sales bans on single use water bottles and plastic bags have been adopted by several communities in the U.S. Plastic bag bans are now in place in over 80 U.S. communities.[119]

#### 5.3.11.6 Consider Mandatory Recycled Content Policies (#39)

Wisconsin could consider mandating that plastic packages and other plastic items have a minimum post-consumer recycled content. This type of recycled content mandate has been attempted before in Wisconsin. Such recycled content mandates may help stimulate demand for recycled materials, but there are questions about feasibility of imposing such requirements at the state level, independent of concurrent action by other states.

#### 5.3.11.7 Consider Mandatory Film/Bags "Take Back" Requirements (#40)

DNR could consider developing plastic film/bag "take back" requirements whereby retailers that sell or use plastic bags or other film products would be required to provide recycling opportunities for these items. This is similar to the concept used in New York City and California.

One potential example is agricultural film. DNR could explore EPR mandates that manufacturers, distributors and on-site installers develop systems for retrieval, processing and recycling of scrap film plastic from the farms at which it was installed. Other forms of waste plastic recovery could also be explored in the ag plastic EPR system (e.g., pelletizing ag film plastic for use as a fuel supplement; plastics to oil; etc.).

## 5.4 Alternative Scenarios

This subsection outlines the concept of an implementation and action plan and then analyzes three alternative scenarios. The first scenario is defined as the status quo without any significant government interventions or changes beyond current growth trends. The second two improvement scenarios are based on this existing Wisconsin systems and national growth trends.

All options listed and described in section 5.3 are categorized into the implementation planning phase or one of the three improvement scenarios.

Appendix 5-E is a matrix that graphically groups all of the options into the planning phase improvement scenarios and then further describes estimated "new" tons per year diverted by the year 2020, DNR's estimated start-up costs, and DNR's estimated cost (or revenue), and the estimated potential new jobs. These are preliminary estimates and will need further refinement once implementation priorities are established. Appendix 5-E displays preliminary consultant team analyses of the cost, effectiveness and degree of difficulty to implement each option. These are preliminary scenarios and cost-effectiveness evaluations (Table 5-2) for the entire spectrum of options. A subsequent phase of this effort should be to develop detailed work plans and budgets for strategies / packages of high-priority options.

### 5.4.1 **Implementation and Action Plan** (Options #1 through #10)

As a primary strategy, DNR could adopt a detailed plastics recycling implementation and action plan. This implementation plan could form the basis for any future improvement scenario by setting priorities to lead and guide system improvements. It is possible that this implementation plan could be completed by June 1, 2013.

The implementation plan includes five key planning and organizing strategies:

- (Option #2) Establish ambitious plastic diversion planning targets (e.g., 100,000 tons) for the year 2020 together with interim goals (e.g., collecting all plastic bottles in the largest municipal curbside programs by the end of 2014; collection of plastic film/bags via retail store drop-off by the end of 2016).

- (Option #6) Hire a temporary market development specialist.

- (Option #7) Form a Wisconsin plastics recycling council.

- (Option #8) Conduct initial outreach, organizing and public relations with the release of this study to get industry feedback. This option could include production of a half-day forum to solicit input on this study and discuss key options and the alternative improvement scenarios.

- (Options #9 and #10) Conduct two feasibility studies:
  - Rigids mixed plastic plastics recycling facility (PRF); and/or
  - Film PRF.

As part of the implementation planning phase, DNR could solicit industry feedback on the need, scope and scale of these feasibility studies. Other tasks are also suggested to support this implementation plan. (See sections 5.3.1 through 5.3.3, Appendices 5-D and 5-E for more details.)

### 5.4.2 **Status Quo Scenario** (Options #11 through #14)

This scenario is defined as following current trends for plastics recycling in Wisconsin without any significant changes or system interventions (i.e., "status quo"). This scenario represents an

assumed approach whereby the private sector grows its own plastics recycling systems without any significant changes in current state policies, programs or plans. The assumption is that plastics recycling will continue its present rate of growth given current status and trends in Wisconsin and nationally in collection and processing systems. (See sections 5.3.1 through 5.3.3, Appendices 5-D and 5-E for more details.)

### 5.4.3 **Partnership-Oriented Intervention Scenario** (Options #15 through #31)

This scenario is defined by planned, phased implementation of new voluntary partnerships and increased private investments, including voluntary producer responsibility programs. This scenario has a comprehensive list of potential improvement options. The categories of activities in this scenario include:

- (Options #15 through #18) Enhance technical assistance to RUs, MRFs and other suppliers.
- (Options #19 through #22) Enhance financing, supply assurance and siting efforts.
- (Options #23 through #26) Promote development of domestic market capacity (especially in Wisconsin).
- (Options #27 through #29) Promote other voluntary producer responsibility options.
- (Options #30 through #31) Develop alternative recovery technologies.

(See sections 5.3.1 through 5.3.3, Appendices 5-D and 5-E for more details.)

### 5.4.4 **Policy-Oriented Scenario** (Options #32 through #40)

This scenario is based on the assumption that an alliance of interests would seek legislative authority to establish prescriptive programs and policies for the increased recycling of specified plastics items. It is recognized that political opposition to legislation without adequate funding at this time will make this scenario challenging. Therefore, the operative assumption is that the partnership-oriented intervention scenario may be the improvement scenario of first choice. Reconsideration and implementation of these mandated policies and programs could be triggered if there is not steady, annual progress towards planning targets and goals using a variety of measurement methods.

(See sections 5.3.1 through 5.3.3, Appendices 5-D and 5-E for more details.)

# 6 Conclusions

A comprehensive list of conclusions are derived from this study. The following are the most important, key conclusions from each section.

## 6.1 Section 1 – Introduction

1. The Wisconsin *Recycling Law* (ch. 287, Wis. Stats.), originally enacted in 1989, authorized a graduated series of disposal bans on landfilling and incineration of certain recyclable materials. In 1995, the disposal ban on plastic containers went into effect, but DNR granted a waiver for all containers except PET and HDPE bottles. DNR determined that only PET and HDPE bottles had adequate markets at that time.

2. The *Wisconsin Recycling Law* delegates responsibility for implementing these bans to Responsible Units (RU's). Implementation of the recycling law emphasizes achieving voluntary compliance through education and technical/financial assistance.

3. The plastics recycling industry has continued to grow and develop over the past 17 years such that a much wider variety of types of plastics are now recycled in certain communities.

4. This study is focused on post-consumer, recyclable plastics from both residential and commercial sources. There are four general categories of post-consumer, recyclable plastics covered in this study:
   - Bottles
   - Non-bottle, rigid containers (sometimes referred to simply as "containers")
   - Bulky rigid plastics (e.g., carts, crates, buckets, baskets, toys, lawn furniture)
   - Film, including plastic bags (e.g., grocery and other consumer bags).

   In general, this study does not analyze the recycling of post-industrial plastics that are generated as plant scrap.

5. The scope of this study is focused on the existing plastics recycling infrastructure that serves Wisconsin generators. This study does not address the feasibility of converting "virgin-only" plastic product manufacturing industries to include a share of recycled resin. There may be many virgin-only manufacturers that are candidates to convert to use of recycled resins if there is an adequate supply in terms of quantity, quality, price and reliable infrastructure.

6. Recycling, as defined under the state Recycling law and policy, means the remanufacturing of recyclable commodities into new products. Recycling does not include waste-to-energy processes, and by definition excludes other forms of converting plastics into fuel or constituent components (e.g., plastics to oil). However, these additional forms of plastics recovery do have an indirect impact on plastics recycling and therefore are addressed as an adjunct strategy in this study.

7. Wisconsin also has a *Plastic Container Labeling Law* that is administered by the Wisconsin Department of Agriculture, Trade & Consumer Protection (DATCP). DATCP

rules permit manufacturers of plastic containers to use national, industry-wide coding systems (e.g., the current ASTM Resin Identification Code system).

8. There are limits on the ability to use DNR recycling data for all of the types of plastics covered in this study. National studies can be used as an alternative to estimate Wisconsin-specific recycling rates.

## 6.2 Section 2 – Background Information and National Trends

1. Recycling is a growth sector in the U.S. economy, and plastics recycling is a particular area of growth within the recycling sector

2. The value of plastics is expected to increase relative to other commodities collected from community recycling programs.

3. National trends indicate that PET and HPDE bottles are the clear "winners" in the race to recycle all types of post-consumer containers, bulky rigid plastics and film / bags. Yet the national recycling rate for PET bottles is only around 28 percent, and approximately 29 percent for HDPE. PP bottles have a recycling rate of 18 percent; PVC bottles around 2 percent; and LDPE bottles around 2 percent. Thus, the vast majority of plastics in the U.S. (and Wisconsin) are currently disposed of in landfills.

4. This study concludes that for the higher value recyclable plastics (e.g., PET, HDPE, clean/separated film), the greatest barrier to growth is supply. The reclamation and end-use manufacturing capacity is adequate, but the lack of new supplies limits growth.

5. For technical and economic reasons, the amount and volume of plastic bottles available for recycling in the U.S. has decreased over the past few years.

6. There are number of notable programs targeting recyclable plastics beyond PET and HDPE bottles. On a national basis, about 94 percent of the U.S. population has access to PET and HDPE bottle recycling services. This compares to about 40 percent of the U.S. population that has access to recycling programs that collect "all plastic bottles and non-bottle rigid containers". There is a clear national trend for recycling programs to collect more types of plastics (e.g., "all bottles" or "all rigid containers").

7. In general, there will be a need to improve bale quality from MRFs as part of any initiative to increase the types of plastics recycled.

8. More MRFs and intermediate processors will be adding automated plastics sorting technologies to their facilities. This development of more automated sorting capacity is driven by technology advances, the continued move to single stream recycling collection systems, initiatives to increase plastics recycling beyond PET and HDPE, and increased complexities of plastic bottle designs (e.g., barrier layers, multi-resin make-up of labels, etc.).

9. The influence of China as a primary export market (especially for PET) will likely continue to decrease over the long term as China develops its own domestic collection

programs and processing infrastructure. This diminishing role of China as an export market provides an opportunity for the U.S. to develop domestic plastics sorting, reclaiming, and manufacturing capacities.

10. Container deposits, while controversial, are a proven system of increasing recycling rates of eligible beverage containers. State and provincial recycling rates for deposit containers are often in the 85 to 90 percent range. In fact, container deposits are one of the only policy options that result in such high recycling rates. Deposits and municipal curbside / drop-off systems can be compatible if the proposed deposit legislation is designed to maximize recycling and minimize negative economic impacts on municipal programs. In addition, a Wisconsin container deposit program could generate about $60 million in unredeemed deposits that could be re-invested back into the recycling infrastructure.

11. Plastic film and bag recycling is also growing in the U.S. Despite this recent growth, the national recycling rate for film remains relatively low at around 10 percent. Large volumes of readily recyclable film are still being missed because the collection infrastructure is not yet comprehensive enough to handle the small to medium generators. A national trade organization, the Flexible Film Recycling Group, is promoting awareness, providing technical assistance and conducting pilots to test the best means of increasing recycling of film. Curbside recycling of film and bags is generally discouraged because of operational problems at MRFs and due to the lower quality film bales produced. Film and bag drop-off services at retail stores are becoming the preferred method of collecting residential materials.

## 6.3 Section 3 – Current Plastics Recycling Systems in Wisconsin

1. There are a wide variety of plastics recycling systems throughout Wisconsin. The extent of municipal and private recycling efforts is impressive. Some companies have made significant investments in plastics recycling facilities. Yet a large amount of valuable plastics, about 574,000 tons per year, still remains in the waste stream.

2. As of 2011, there were about 1,060 RUs in the state. Residential recyclables collection is provided by curbside collection and/or drop-off facilities either directly, through contract or by haulers via open hauling systems.

3. There are more than 85 registered MRFs in the state; 55 percent are privately owned and/or operated; and 45 percent are county or municipal facilities. Often, a smaller MRF or transfer operation will haul unprocessed recyclables to a larger MRF.

4. As part of national study published in 2011, a survey found for Wisconsin cities over 10,000 in population: 9 percent had access to recycling for all plastics; 24 percent had access to recycling all bottles; and 31 percent had access to recycling only PET and HDPE bottles. All of these cities had some form of plastics recycling available.

5. Several of the larger solid waste management / recycling companies (e.g., Waste Management; Republic/Allied; Veolia) have recently announced they accept a more

complete list of plastics (e.g., at least "all rigid plastic containers" or RIC types #1 - #7) in their private recyclables collection operations.

6. According to DNR data for 2010, four facilities reported that they receive plastics in dual-stream systems, and 31 MRFs reported that they use single-stream recycling systems.

7. About 27,000 tons of plastic were reported recycled by the top 20 Wisconsin MRFs in 2010. These MRFs represent about 74 percent of Wisconsin's reported total recyclables. Another five MRFs located outside of Wisconsin handle 17 percent of all Wisconsin plastics.

8. Many communities will have adequate recycling collection and processing capacity to accept a broader list of plastics beyond PET and HDPE bottles. However, some of the smaller MRFs were designed to handle only PET and HDPE bottles and would require significant capital equipment investments to handle additional plastic types (e.g., to add additional sorting and storage capacity).

9. Automated plastic sorting equipment has been installed in many of the largest MRFs and can automatically detect and sort the large volume types of plastics such as PET and HDPE bottles. Even when automatic sorting machines are installed, manual sorting is still always employed for quality control. Manual separation is still the most common (i.e., state-of-the-art) method of separating plastics at MRFs.

10. While most MRFs do sort and process plastic film and bags, this is often a low value by-product or waste material that is disposed of. Several of the MRFs indicated that they cannot cost-effectively add film plastics to their incoming recyclables stream because of the operational and equipment problems caused by film.

11. In many areas of Wisconsin, there is growing infrastructure in place for separate recycling of plastic film, wraps and bags through drop-off bins at retail locations (e.g., larger grocery stores). The film collected from consumers is typically combined with pallet wrap generated in the back of the stores and "back-hauled" to markets.

12. Away from home recycling is a relatively new and largely undeveloped program initiative. For many reasons, compliance with the *Wisconsin Recycling Law* by non-residential establishments has not been emphasized.

13. There is a wide diversity of public education programs and a large variety of how plastics are described and listed for recycling. The recycling of plastics is inherently confusing to the public. But the lack of any form of standardized public education messaging discourages participation and limits growth of new recyclable supplies of plastic.

14. Markets for this study are defined as those companies that process recyclable plastics from community programs and commercial establishments. Market categories include reclaimers (sorting, washing, grinding, pelletizing and/or compounding) and end-use manufacturers. Some end-use manufacturers are vertically integrated to include reclaiming facilities.

15. Results from interviews and other sources indicate that there is adequate market capacity for clean, sorted PET, HDPE, LDPE and PP containers and clean PE film. Domestic markets for PVC and PS are more limited.

16. Results from the DNR's *2009 Wisconsin State-Wide Waste Characterization Study* indicated that over 22,000 tons per year of PET and 13,000 tons of HDPE are discarded for disposal each year.

17. For all categories of plastics, the industrial, commercial, institutional (ICI) sector is the largest source of plastic disposed at about 65 percent (374,000 tons per year of mostly post industrial plastic). Residential sources comprise about 34 percent (193,000 tons per year of post consumer plastic) of plastics disposed.

18. Based on average market prices, Wisconsin throws away $64 million worth of plastics each year (including all types of plastics and assuming these materials could be sorted and processed for marketing); $42 million from the ICI sector and $22 million from the residential sector.

19. One of the most important barriers to improving plastics recycling is increasing the amount of recyclable plastics. The emphasis of government and private efforts should be on immediate strategies to increase supply.

20. Removing the statewide waiver on the disposal bans on all rigid plastics and clean film / bags may help increase supply. This increase in supply may help Wisconsin recyclable plastics markets grow their business and also attract new industries to the state. However, most of the MRFs do not believe the infrastructure is strong enough, at least for the non-banned plastic containers, for them to invest in processing this waste stream.

21. Alternative recovery technologies (e.g., waste to energy; plastics to oil) have the ability to consume large quantities of waste plastics. These alternative technologies should be considered for the non-recyclable plastics that are either too contaminated or do not have any end-use recycling markets.

## 6.4 Section 4 – Economic and Job Development

1. There is very strong economic and job development potential from plastics recycling. There is greater potential for new jobs and economic multiplier benefits from the manufacturing side of recycling systems compared to collection and processing. One study found that for every plastics reclaimer, about 25 jobs are created with average annual receipts of about $2 million per year.

2. Wisconsin's plastics industries overall (including manufacturers that use virgin resins only) employ about 39,800 people and with a direct payroll of $1.6 billion. Plastics dependent industries add another $12.9 billion to the state's payroll. Within the U.S., Wisconsin is ranked 8$^{th}$ in plastics industry employment in part due to the business climate, skilled labor force, and related academic training institutions.

3. There are several federal and state economic development programs that are charged with helping small business grow. There are greater opportunities to take advantage of these financial and technical assistance resources if a coordinated approach towards plastics recycling in Wisconsin can be developed. DNR should partner with WEDC to leverage the strengths and resources of each organization to significantly improve plastics recycling in Wisconsin. Other economic development organizations should also be included such as WMEP and NWMORC.

4. A key barrier to the growth of plastics recycling is lack of adequate supply assurance for new or growing companies. This may be addressed through a series of financial, siting and technical assistance initiatives. One concept that may have value for new plastics recycling facilities is to locate within an eco-industrial park where a MRF or other related operations may already be located. These types of supply assurance mechanisms need proactive incentives to be successful.

## 6.5 Section 5 – Alternative Improvement Options

1. This study outlined 40 individual improvement options, an implementation planning phase as a next step, and three alternative scenarios. Key, selected options for the next stage of implementation planning include:

    - Establish ambitious plastic diversion planning targets (e.g., 100,000 tons) for the year 2020 together with interim goals (e.g., collecting all plastic bottles in the largest municipal curbside programs by the end of 2014; collection of plastic film/bags via retail store drop-off by the end of 2016).

    - Form a Wisconsin plastics recycling council to help implement these new programs.

    - Hire a temporary market development specialist.

    - Conduct initial outreach, organizing and public relations with the release of this study to get industry feedback.

    - Conduct two separate feasibility studies on the development plastics recycling facilities to determine the scale, scope and potential economics of new operations to sort if not reclaim two types of plastics:
        - Mixed rigid plastic containers and bulky rigid materials; and
        - Plastic film/bags.

2. This study outlines three broad planning scenarios, each with varying levels of government action:

    - Status quo scenario
    - Partnership-oriented scenario
    - Policy-oriented scenario

    Options are described within each of these scenarios, including potential DNR role, estimated new tons per year of plastics diverted, estimated state start-up cost, estimated state annual

operating cost, and estimated potential new jobs. These are very preliminary estimates and intended to provide a rough means of comparing options and are not intended for budgeting or other formal resource allocations.

3. The partnership-oriented scenario may be the best means to significantly improve plastics recycling in Wisconsin. This package is based on a series of voluntary producer responsibility options and is the most diverse and comprehensive of the three scenarios.

4. The policy-oriented scenario contains proposed legislated options, including container deposits, removing the disposal waiver for all bottles (2014) and all rigid containers (2016), additional landfill surcharges, and material "take back" requirements. The diversion planning targets are proposed as triggers for consideration of some combination of these policies. That is, if adequate progress towards increased plastics recycling is not successful under the partnership-oriented scenario, then legislation would be forwarded for legislative consideration.

# Appendices

[SEE SEPARATE DOCUMENT]

# Endnotes

[1] Wisconsin Statutes, *Solid Waste Reduction, Recovery* and *Recycling Law*: http://docs.legis.wi.gov/statutes/statutes/287

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[23] APR, 2010, ibid.

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