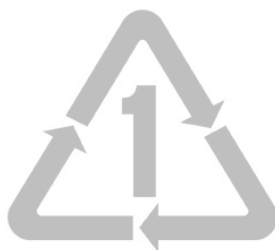


Report on

Postconsumer PET Container Recycling Activity in 2015



October 13, 2016



www.napcor.com



The Association of
Plastic Recyclers

www.plasticsrecycling.org

ACKNOWLEDGEMENTS

2015 marks the twenty first year that the National Association for PET Container Resources (NAPCOR) has issued this report, and the eleventh year that NAPCOR and The Association of Plastic Recyclers (APR) have worked together to produce it. This report would not be possible without the APR's support and the cooperation of its members and NAPCOR's. Information contained in this report was obtained through surveys conducted by HDR, Inc. and Moore Recycling Associates, and from data generated internally by NAPCOR. In order to present as accurate a picture of these activities as possible, additional data and information were obtained through discussions with individual collectors, intermediate processors, reclaimers, converters, brokers, exporters, importers, resin producers, bottle manufacturers, public recycling officials, consultants, and other key industry members.

ABOUT THE SPONSORS

Founded in 1987, the **National Association for PET Container Resources (NAPCOR)** is the trade association for the PET plastic packaging industry in the United States, Canada and Mexico. NAPCOR is dedicated to promoting the PET package; to overcoming hurdles to the successful recycling of PET; and to communicating the attributes of the PET container as a sustainable package. More at www.napcor.com

The Association of Plastic Recyclers (APR) is the "Voice of Plastics Recycling™." As the international trade association representing the plastics recycling industry, membership includes independent recycling companies of all sizes, processing numerous resins, as well as consumer product companies, equipment manufacturers, testing laboratories, organizations, and others committed to the success of plastics recycling. APR advocates the recycling of all plastics. Visit www.PlasticsRecycling.org for more information.

SUMMARY

This report is intended to provide the reader with a detailed overview of the recycling of injection stretch blow molded polyethylene terephthalate (PET) bottles and jars in the United States (US) during 2015, and a general summary of the recycling of PET thermoforms.

In 2015, approximately 5,971 million pounds of PET bottles were sold into the marketplace in the US. About 30.1 percent of those – 1,797 million pounds – were collected through recycling programs and sold, either to domestic or foreign markets. PET reclaimers in the US supplemented those bottles collected in the US with imported materials and alternative feedstocks to process a total 1,548 million pounds of material. A variety of end users in the US, led by producers of fiber, consumed the clean RPET flake produced by US reclaimers, as well as imported RPET from Canada and other countries.

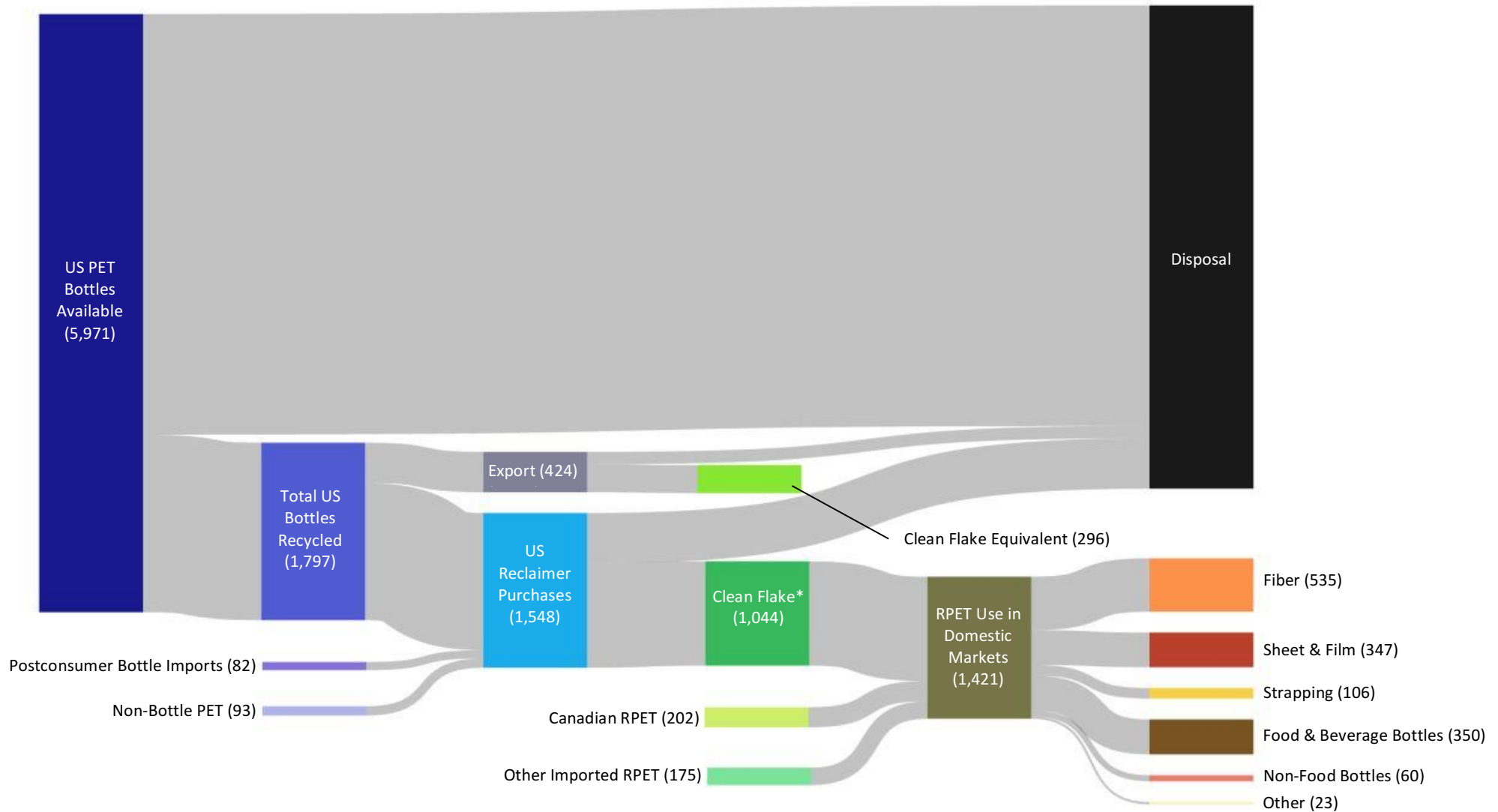
PET material flows in the US are depicted in Figure 1. This report uses color coding to aid readers in following material flows throughout the report; a color reference guide is provided in Appendix A. Comparative historical data is provided in Appendix B.

PET BOTTLES AVAILABLE FOR COLLECTION

The total weight of PET bottles and jars available in the United States for recycling in 2015 was 5,971 million pounds, a two percent increase over 2014. This number reflects the total amount of PET resin used by US bottle manufacturers from US, foreign, and recycled sources, with adjustments for scrap generated and not reused in bottles, exported bottles and pre-forms, and bottles less than eight ounces in size. This 5,971 million pounds serves as the denominator in this report to determine both the recycling and material utilization rates; it includes 379 million pounds of postconsumer PET recycle.

Several market factors and trends affected the volume of PET bottles available for recycling collection in the US in 2015. Negative factors included continued weakness in carbonated soft drink sales, combined with some reductions in single-serving bottle sizes to provide market differentiation and meet consumer demands. Light-weighting of bottles continued to have an impact on some specialty beverage categories, but to a lesser extent than in previous years. On the positive growth side, there was some conversion into PET from other package types – both in food and beverage and non-food market segments – and bottled water sales continued to increase, as did specialty beverage categories such as energy and sports drinks, teas, and ready-to-drink coffees.

FIGURE 1: PET Material Flows in the US (MMlbs)



* This total represents all clean flake sold into end markets by US reclaimers. See figure 7 for detail on total flake produced by US reclaimers from bottles.

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POSTCONSUMER PET BOTTLE PURCHASES

The total amount, by weight, of postconsumer PET bottles collected for recycling in the United States and sold to recycling markets in 2015 was 1,797 million pounds. The breakdown of this total, by purchaser, is as follows:

TABLE 1: Recycling Rate Numerator

1,373	Purchased by US Reclaimers
410	Purchased by Export Markets
14	PET bottle component of mixed bales exported
1,797	Total Postconsumer Bottles (MMlbs)

This represents a 15 million pound, or one percent, decrease in total volume of bottles collected as compared to 2014. Because the amount of bottles available for recycling increased in 2015, and the bottles collected decreased, the recycling rate dropped nearly one percent to 30.1.

The decrease in collection volumes in 2015 appears to be the result of a drop in PET collected at curbside. The amount of material collected through the California CRV (CA CRV) program increased, while PET collected in other state deposit programs decreased only slightly. The drop in deposit redemption (outside of California) probably results from the declining market share for carbonated soft drinks (CSD) – the predominant category in most state programs.

The slight decline in PET bottle recovery was likely attributable to a number of factors. First, poor market conditions may have caused certain commercial collectors to reduce or eliminate recycling collections. Second, the continued

PET Thermoform Recycling

In 2015, PET thermoforms collected for recycling in the US and Canada dropped to 88.5 million pounds, from a peak of more than 100 million in 2014. The decline was primarily in exported thermoforms. A slight decrease in US reclaimer recovery of thermoforms was more than offset by an increase in Canadian usage.

PET thermoform collection volumes are not included in the recycling rate presented in this report, or in the bottle volumes purchased, but are included in total reclaimer PET purchases (page 6) and “flake produced from all sources” totals cited on page 13.

The decline in PET thermoforms collected for recycling is attributable to poor export markets in 2015. The slight increase in use of these materials by North American reclaimers illustrates that the work of NAPCOR and its partners to work through technical concerns to develop this promising new source of supply continues to reap benefits.

In light of this data, NAPCOR continues to work toward its goal of making PET thermoforms as easy to recycle as bottles. While some PET reclaimers are enthusiastic about incorporating this new source of supply, others will only accept PET thermoforms from high quality suppliers who utilize auto-sort equipment, while still others exclude PET thermoforms from their incoming material specifications altogether.

Clearly, PET thermoforms are technically recyclable with PET bottles, however, not all thermoforms are PET. Given the difficulties reclaimers face with recent increases in contamination, the potential for increases in “look-alike” packages (e.g., OPS, PVC, PETG, PLA), and non-recyclable labels, inks and adhesives, can put a damper on reclaimers’ enthusiasm for incorporating this growing stream. In 2016, NAPCOR continues to work to address these concerns and overcome the obstacles to broad-scale PET thermoform recycling.

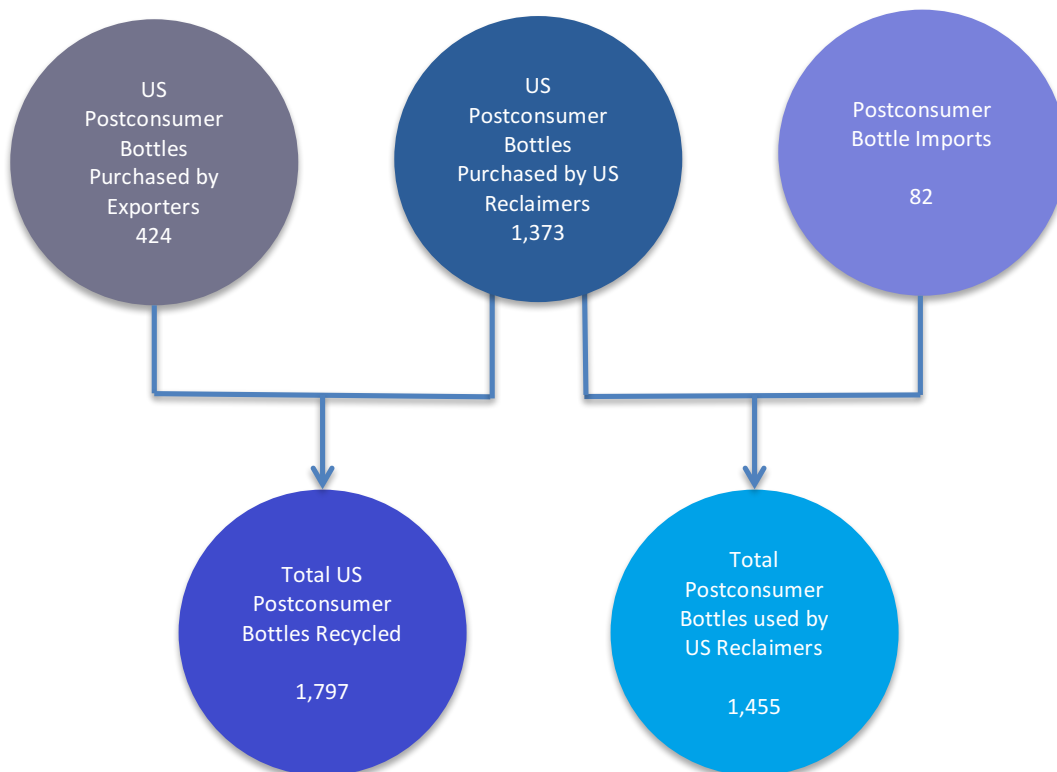
Recycling programs and MRFs interested in marketing PET thermoforms should talk to their buyers about market opportunities. As they move to implement programs, it is critical that collectors and processors implement best practices to minimize contamination and maximize quality.

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impact of lightweighting, downsizing of single-serve beverage containers, and reductions in sales of CSD all could have impacted collection, as fewer CSD containers were available, and the bottles that were available were of lighter weight. Given the light weight of water bottles, the increase in their sales does not compensate for the loss of soft drink containers in the PET collection stream. Third, industry data suggests that light weight PET bottles are more likely to be lost or misdirected in a materials recovery facility (MRF), meaning that a portion of bottles that were separated for recycling may not have made it to the PET bale for sale to reclaimers.

United States reclaimers decreased their purchases of US bottles by 25 million pounds, or 1.8 percent, as compared to 2014. Total US purchases accounted for 76 percent of all US bottles collected, just below the 77 percent reported in 2014. United States reclaimers also reported supplementing their domestic purchases by importing 82 million pounds of postconsumer bottles or dirty flake, predominantly from Canada, Mexico and Central and South America, a significant decrease as compared to the 177 million pounds imported in 2014. In addition to the bottle volumes as presented in Figure 2, domestic reclaimers reported buying 93 million pounds of alternative feedstock, which included postconsumer thermoforms, pre-consumer bottles, postconsumer strapping, and other unprocessed industrial scrap, a slight increase over the 85 million pounds purchased in 2014. In total, US reclaimers purchased 1,548 million pounds of PET scrap material.

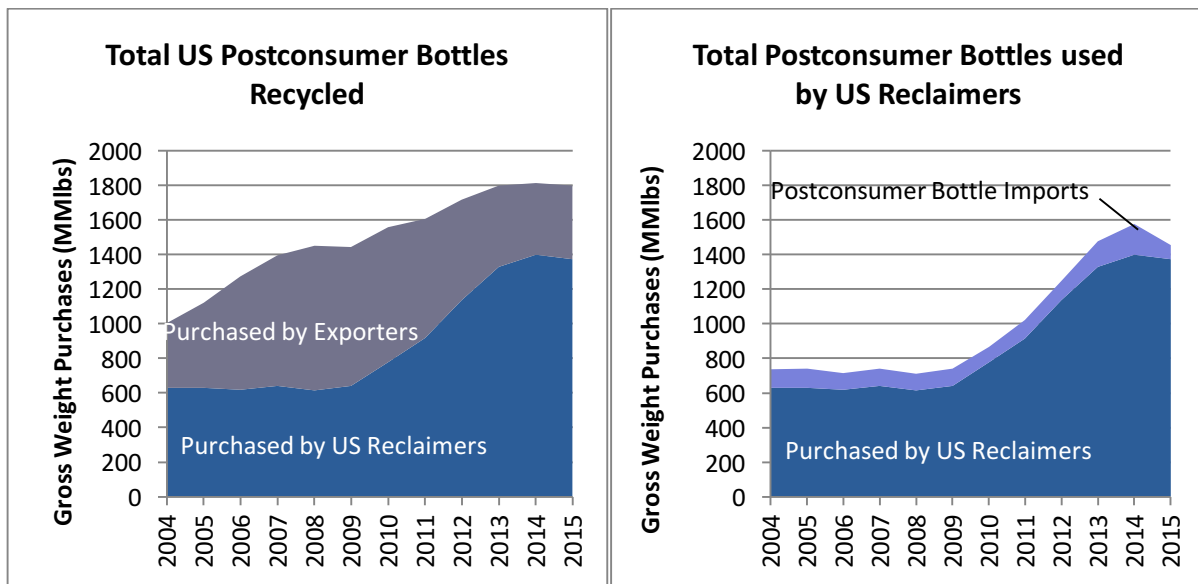
FIGURE 2: Postconsumer Bottles Recycled & Used by Reclaimers



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Reclaimers outside of the US purchased a total of 424 million pounds or 24 percent of total US bottles collected. This is nearly as low as the 23 percent reported in 2014 – the lowest percentage of total collections since 2000. The purchase of US bottles by Canadian reclaimers increased significantly, to 75 million pounds, up from 45 million last year. PET bottle bale exports to the Far East, predominantly to Chinese buyers, totaled 335 million pounds, down by 24 million pounds as compared to 2014. Exports of the estimated PET bottle fraction of mixed plastic bales increased to 14 million pounds versus 10 in 2014.

FIGURE 3: Postconsumer Bottles Recycled & Used by Reclaimers



2015 GROSS RECYCLING RATE

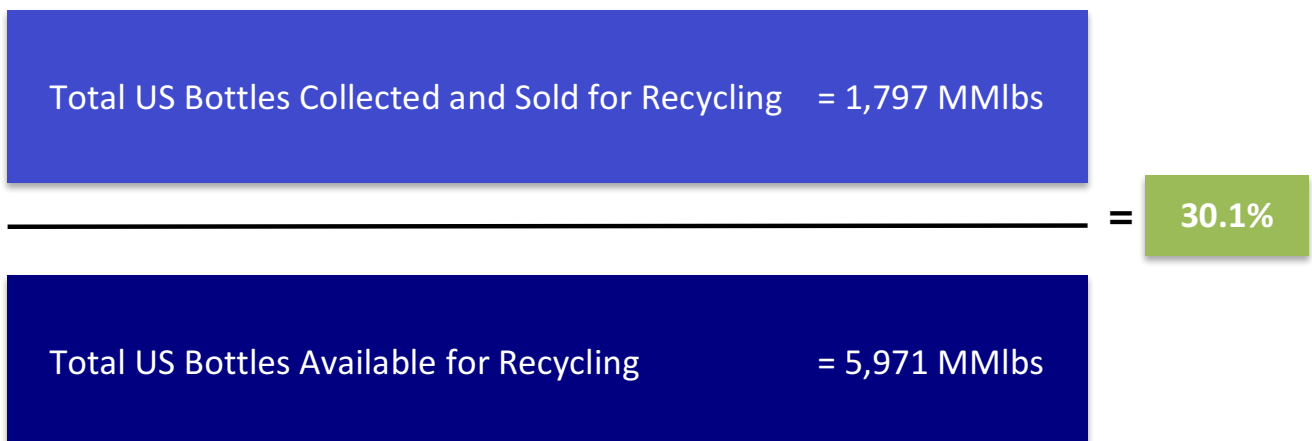
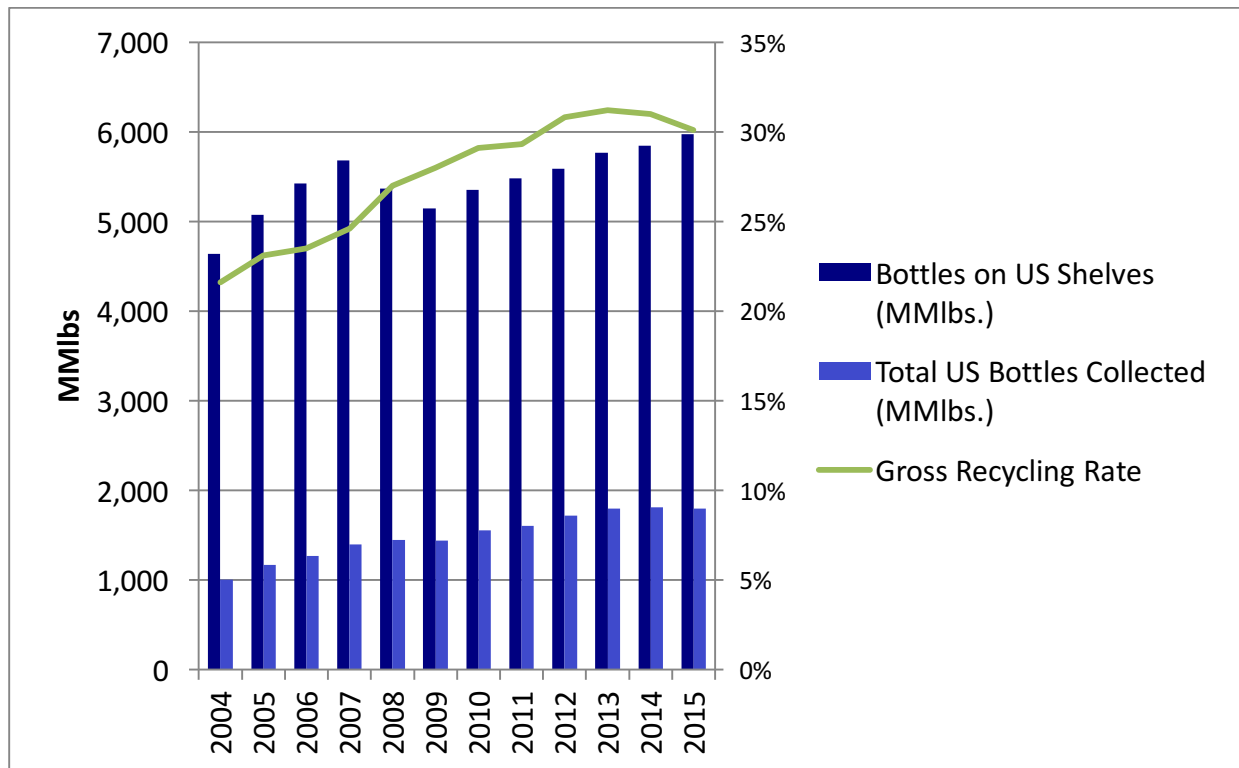


FIGURE 4: Gross Recycling Rates, 2004 – 2015



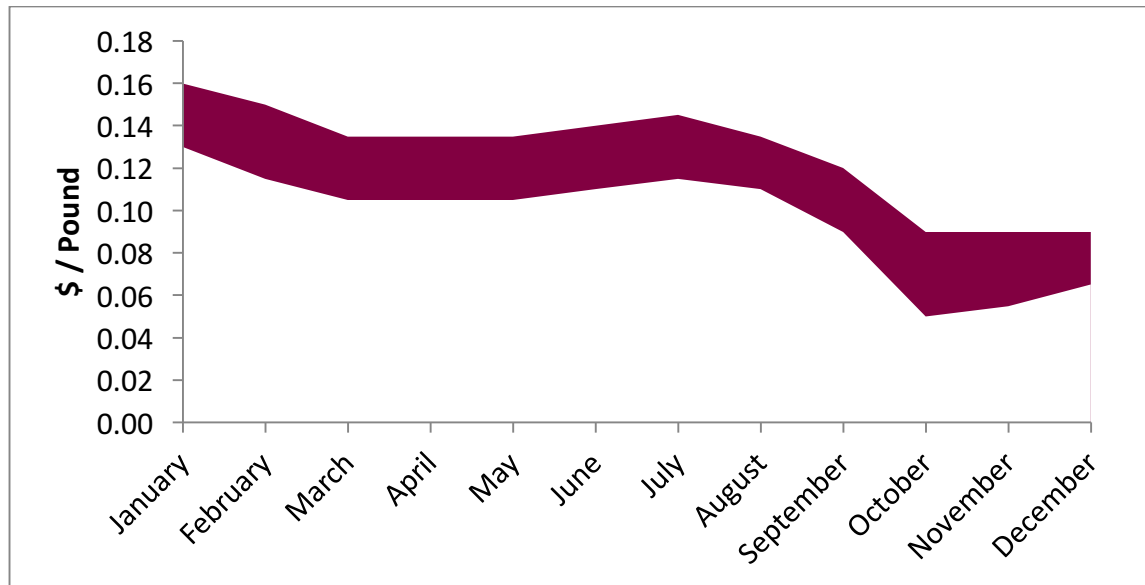
PET BOTTLE BALE MARKETS

PET bottle bale prices dropped dramatically in the US in 2015. From the mid- to high teens in the fourth quarter of 2014, the average price per pound of baled material declined steadily throughout 2015, reaching average lows of \$.05 to \$.09 by year’s end – the lowest prices seen since the market collapse in late 2008 and early 2009. The precipitous decline reflected a combination of market factors including falling oil prices and excess global virgin PET supply, as well as a softening of Asian and other global economies.

On the West Coast, base pricing for high quality (Grade A) California baled PET material, delivered pier, averaged in the \$.18-.20 per pound range throughout the first half of the year, declining steadily after August to finish the year at an average of \$.15 per pound. Export declines reflected the larger global market factors mentioned above, as well as a severe West Coast port backlog, primarily caused by labor disputes. While the labor disputes were formally resolved in February, the ports were not fully recovered and back to normal operations until mid-summer.

FIGURE 5: East Coast, Non-Deposit PET Bottle Bale Prices

(Monthly Average Low / High Range - Picked Up, Truckload Quantities, Seller's Dock)



RECLAMATION CAPACITY

A reclamation plant is defined as an operation that can take dirty postconsumer plastic packaging and process it into a clean flake suitable for remanufacture; all known US operations are included in NAPCOR's inventory regardless of size. At the beginning of 2015, there were 27 US PET reclamation plants in operation, with a combined annual capacity of 2,385 million pounds, gross weight input. By year's end, there were 28 plants operating in the US with total annual nameplate capacity of up to 2,495 million pounds. These plants employ a wide range of technologies, with 14 of the 28 able to produce Food and Drug Administration (FDA) Letter of No Objection (LNO) direct-contact recycle suitable for food and beverage packaging use.

The 2015 US reclaimer plant utilization rate – total throughput, based on the use of all PET feedstock, expressed as a percentage of total plant capacity – was approximately 62 percent in 2015, down from 2014's 70 percent. This reflects plants that were semi-operational, shut down for retrofits or upgrades; and new plants or those that operated for only a portion of the year.

FIGURE 6: Production of PET Flake from Bottles

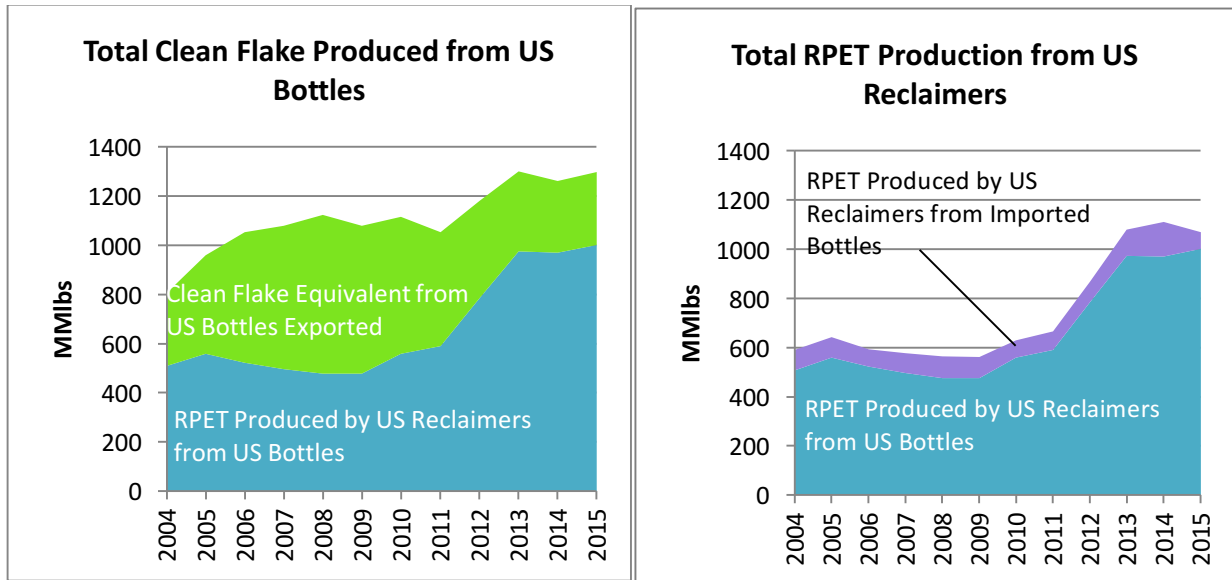
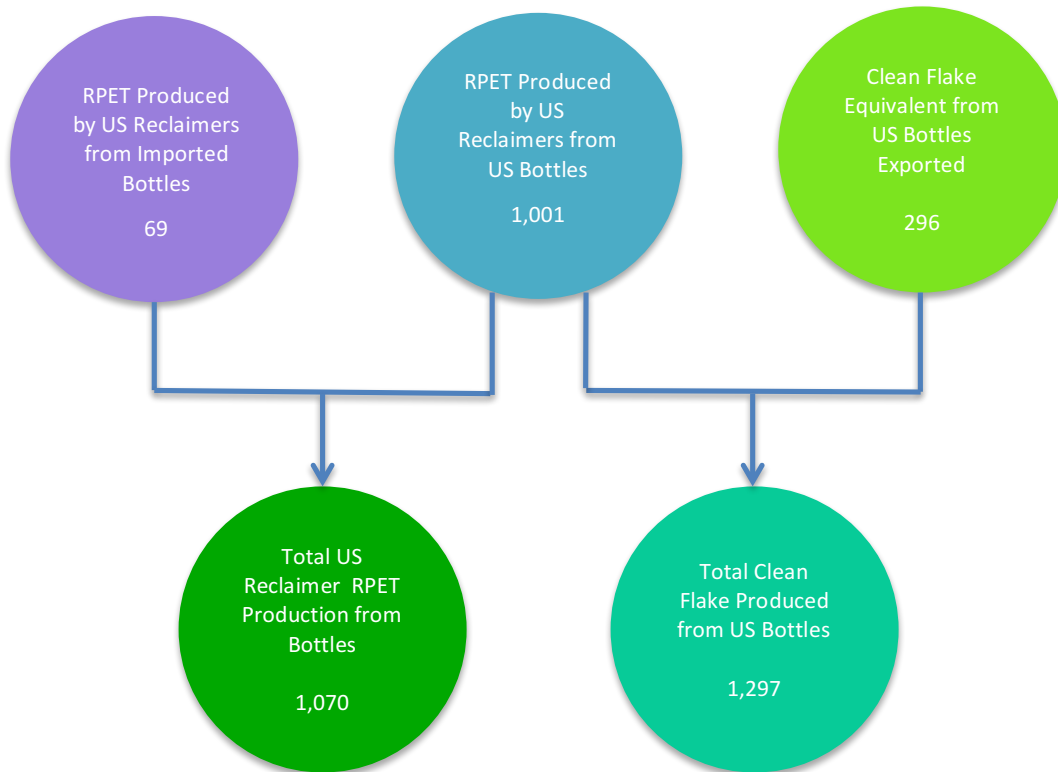


FIGURE 7: PRODUCTION OF PET FLAKE FROM BOTTLES



PET UTILIZATION RATE

The PET utilization rate is determined by adding the amount of clean flake produced by US reclaimers from US bottle material to the amount of clean flake expected to be produced from exported bottles; the sum is expressed as a percentage of total US bottles available for recycling. The PET utilization rate is an expression of system efficiency – how much usable end product (clean flake) reclaimers were able to produce from incoming material purchased. It is presented alongside the recycling rate, and accounts for processing waste and other yield loss (Figure 8).

It is important to note that material utilization rates are not a direct reflection of bale yields for a given calendar year for the following reasons. The report methodology uses survey-derived data of the aggregated amounts of recycled PET container material inputs, including both whole bottles and dirty flake, at the point of reclaimer purchase. Clean flake production is reported on the basis of flake produced in the calendar year. As a result, the utilization rate could reflect production from materials that were already in inventory as the year began. This appears to be a more significant factor in 2015 than it has been in the past. Alternatively, higher use of dirty flake, which contains fewer contaminants than bottle bales, can increase the utilization rate.

PET Bottle Material Utilization Rate



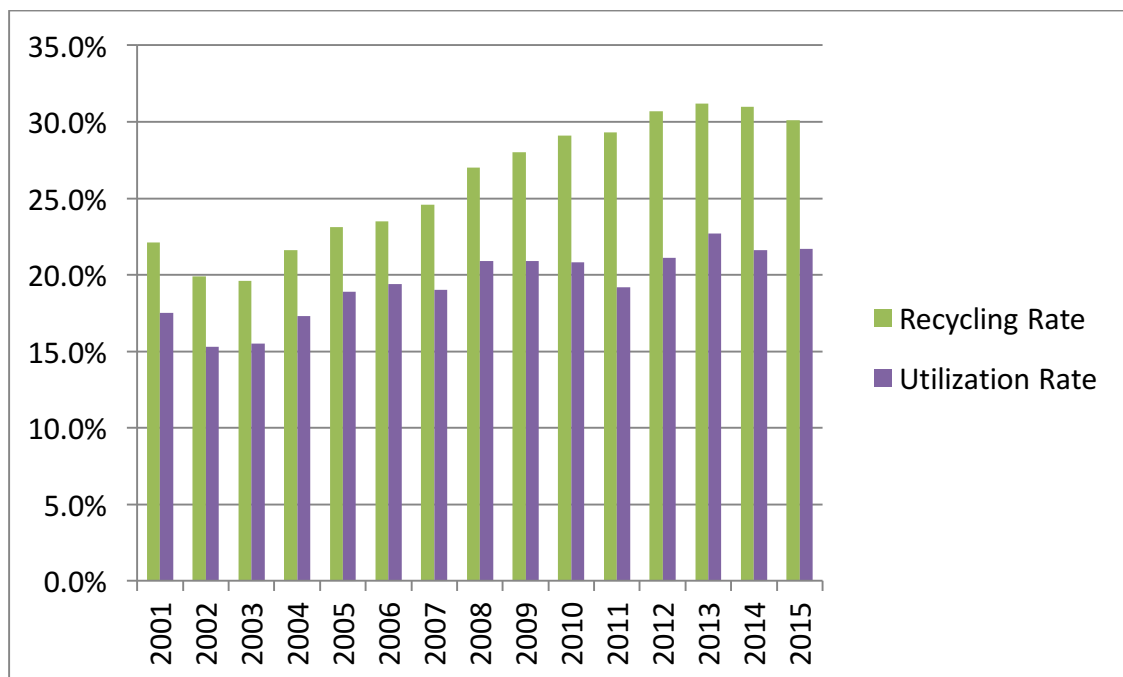
NAPCOR also calculates United States reclaimers’ average production rates by collection source – taking reported clean flake produced from US bottle material in three major collection categories as a percentage of reported incoming material purchased in that category. These rates were generally up in 2015, rising to 80 percent for deposit bottles and 70 percent for curbside material, with California CRV remaining at 2014’s 74 percent. However, the curbside utilization rate is likely overstated, due to certain reclaimers, for a variety of reasons, consuming bale inventory purchased in 2014 to produce flake in 2015 and not restocking with 2015 bales. Precisely for this sort of reason, collection method production rates are not true measures of bale yield.

As diagramed above, after applying estimated production rates to the export fractions purchased, NAPCOR determined that the clean flake equivalent of the 424 million pounds of postconsumer PET bottles exported to all locations was 296 million

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pounds. Adding this to the total flake produced in the US from US bottles from all collection sources, the resulting PET utilization rate was 21.7 percent, roughly equivalent to the 21.6 percent reported in 2014, taking into account the elevated curbside flake production volumes previously mentioned. This year's utilization rate marks no change to the trend observed over the last few years, and illustrated in Figure 8, in which we see a significant gap between the amount of PET postconsumer bottle material purchased by reclaimers (the recycling rate) and the amount of clean flake produced (the utilization rate). This continues to reflect multiple factors: non-PET contamination in curbside bales; the prevalence of smaller, lighter containers, requiring more processing per pound of material; and ongoing design for recyclability issues. Design for recyclability concerns include labels that are difficult-to-remove or separate from PET or block autosort function; barrier layers added to PET to preserve product integrity and extend shelf-life; and metal integrated into PET packages, whether in closures, closure rings, can tops, or pump springs.

FIGURE 8: PET Recycling & PET Material Utilization Rates



Poor PET bale quality, and the growing prevalence of hard-to-recycle packages, particularly in curbside sources, continues to plague the reclaiming industry with high costs and operational challenges. In 2015, these pressures were exacerbated by challenging market conditions due to low virgin resin prices that put pressure on RPET markets and narrowed reclaimer margins.

2015 RPET MARKET

Recycled PET use in domestic end markets remained robust, although combined end market totals reflected a nine percent decrease in 2015 as compared to 2014, with total converter consumption at 1,421 million pounds across all product categories (see Figure 9).¹ This figure includes all material sources, with US and Canadian reclaimers and “upgraders” (companies that purchase dirty flake, have it toll washed, then pelletize or solid-state it for re-sale) supplying about 1,247 million pounds of flake and pellet produced from all sources of feedstock. The remaining 174 million pounds of recycled PET was imported from reclaimers in countries including Indonesia, Dominican Republic, Mexico, Peru, Ecuador and others in Central and South America. Not counted in these totals, United States and Canadian reclaimers also sold 50 million pounds of PET byproducts to secondary markets.

Looking at specific market segments, domestic Food & Beverage Bottle RPET usage held steady, with Non-Food Bottle usage up more than five percent, for a combined bottle total of 411 million pounds. Total recycled PET material used in all packaging applications – including both bottle and sheet – totaled 758 million pounds, down two percent as compared to 2014. While the domestic fiber industry is still vibrant, 2015’s low virgin resin prices and broad availability of low-cost, alternative streams such as post-industrial and off spec materials drove the more price sensitive RPET consumers in fiber markets to other feedstocks. Canadian recycled PET end-use markets are included in end use categories totals below. In Canada, RPET usage was up overall, with growth in Fiber, Bottle and Sheet categories.

¹ Since the 2009 report, the RPET end-use data reflected in Figure 9 has reflected RPET consumption by converters in both the US and Canada.

FIGURE 9: RPET used by Product Category (MMlbs)

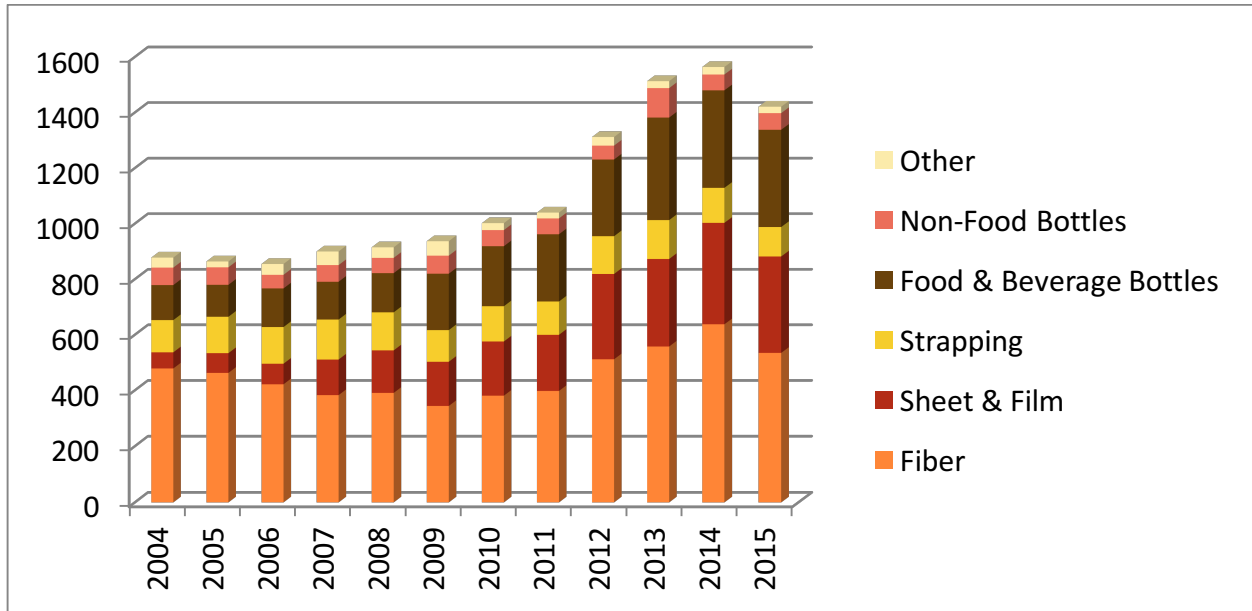
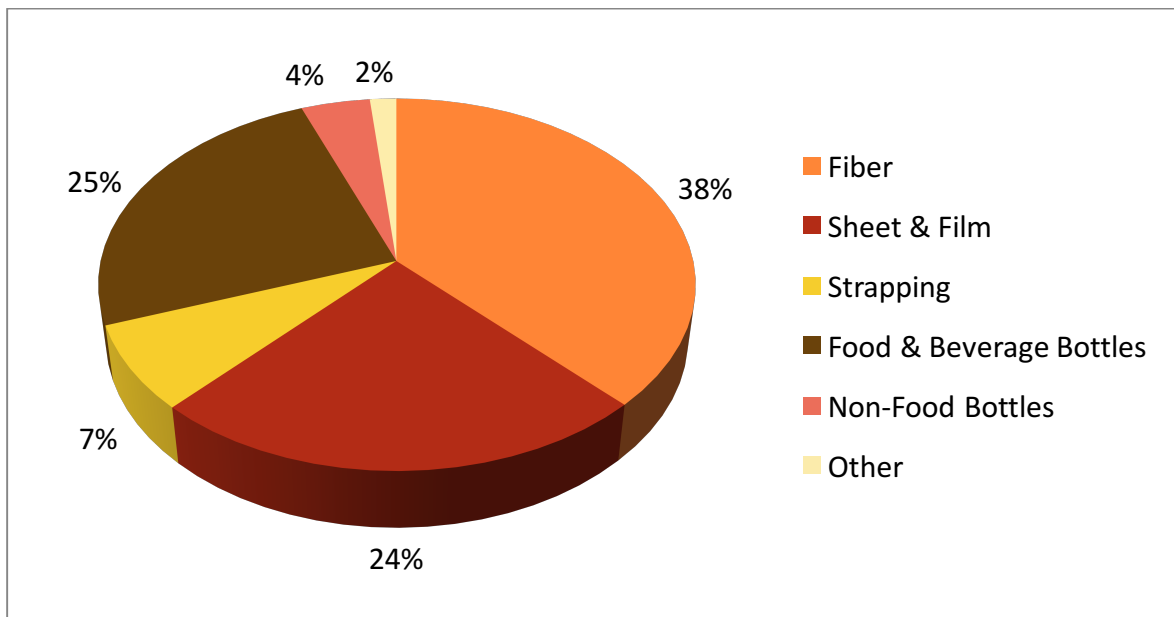


FIGURE 10: RPET used by Product Category in 2015 (MMlbs)



2015 YEAR-END SUMMARY

The following summary highlights the key trends related to postconsumer PET recycling in 2015:

Demand for recycled PET was mixed: most end-use markets, including Sheet & Film, and Bottles, held their own, or saw slight decreases in 2015, while the fiber market – the largest end use of RPET – experienced a substantial decrease. Despite the fact that low virgin PET prices drove price sensitive consumers away from RPET, demand was still sufficient to support the domestic reclamation of most of the material collected in the US. This illustrates the resilience of the PET reclamation industry, as it was able to adapt to what some would describe as abysmal market conditions and continue to absorb the domestic supply of postconsumer bottles.

Supply quality and quantity remain major concerns: the high contamination levels and low bale yield rates reported by reclaimers in prior years persisted in 2015, particularly in curbside PET bales. With regard to quantity, 2015 saw a minor decrease in collection, resulting in a small reduction in the recycling rate. Following on the slight decrease in 2014, this appears to be a trend and one NAPCOR hopes to reverse. While some softness in end market demand may persist, domestic PET reclaimers can still absorb additional materials since they continue to meet a portion of their needs through imports and alternative feedstocks.

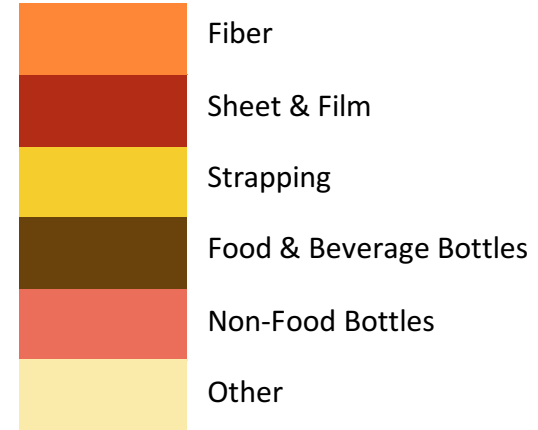
Thermoform packaging recycling domestically is stable: the decrease in the amount of thermoforms collected for recycling in 2015, as compared to 2014, corresponds to a reduction in exported thermoforms. Although the overall collection rate went down, the domestic utilization increased slightly, demonstrating that NAPCOR's efforts, and those of its members and partners, to open recycled PET markets to thermoforms is bearing fruit. While including thermoforms in PET bottle bales is not yet acceptable to all reclaimers, an increasing number are adjusting their specifications to allow for a set percentage of PET thermoforms in bottle bales, or accepting thermoforms in bottle bales from good quality suppliers with auto-sort capabilities.

Appendix A – Color Reference

Used in Material Flow Diagram

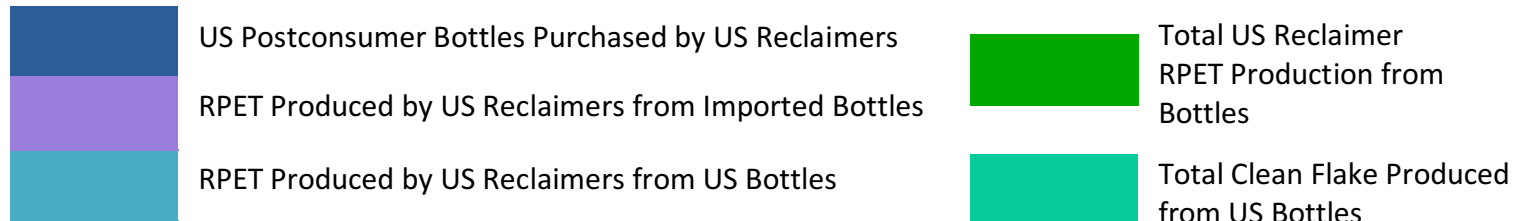


End Markets



* This total represents all clean flake sold into end markets by US reclaimers. See figure 7 for detail on total flake produced by US reclaimers from bottles.

Other



Appendix B – Data Tables

TABLE 2: Postconsumer Bottles Recycled / Used by Reclaimers
Gross Weight Purchases (MMlbs)

- A. Purchased by US Reclaimers
- B. Purchased by Exporters*
- C. Total US Material Recycled (A+B)**
- D. Postconsumer Bottle Imports
- E. Total Postconsumer Bottles used by US Reclaimers (A+D)**

	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>
A.	605	549	580	656	588	599	600	522	520	631	681	619	641	615	642	776	916	1,135	1,329	1,398	1,373
B.	170	148	111	89	183	170	234	275	321	372	489	653	755	836	802	781	688	582	469	414	424
C.	775	697	691	745	771	769	834	797	841	1,003	1,170	1,272	1,396	1,451	1,444	1,557	1,604	1,718	1,798	1,812	1,797
D.	46	87	66	101	60	69	70	57	62	106	109	97	100	98	98	89	106	114	149	177	82
E.	651	636	646	757	648	668	670	579	582	737	790	716	741	713	740	865	1,022	1,249	1,478	1,575	1,455

* As of 2005, this number includes the amount of PET sold in mixed bottle bale shipments.

TABLE 3: Gross Recycling Rates, 1995 – 2015

Year	Total US Bottles Collected (MMlbs)	Bottles on US Shelves (MMlbs)	Gross Recycling Rate
1995	775	1,950	39.7%
1996	697	2,198	31.7%
1997	691	2,551	27.1%
1998	745	3,006	24.8%
1999	771	3,250	23.7%
2000	769	3,445	22.3%
2001	834	3,768	22.1%
2002	797	4,007	19.9%
2003	841	4,292	19.6%
2004	1,003	4,637	21.6%
2005	1,170	5,075	23.1%
2006	1,272	5,424	23.5%
2007	1,396	5,683	24.6%
2008	1,451	5,366	27.0%
2009	1,444	5,149	28.0%
2010	1,557	5,350	29.1%
2011	1,604	5,478	29.3%
2012	1,718	5,586	30.8%
2013	1,798	5,764	31.2%
2014	1,812	5,849	31.0%
2015	1,797	5,971	30.1%

TABLE 4: East Coast, Non-Deposit PET Bottle Bale Prices – Average High / Low
(Picked Up, Truckload Quantities, Seller’s Dock)

2015	<i>LOW</i>	<i>HIGH</i>
JANUARY	\$0.13 / pound	\$0.16 / pound
FEBRUARY	0.115	0.150
MARCH	0.105	0.135
APRIL	0.105	0.135
MAY	0.105	0.135
JUNE	0.110	0.140
JULY	0.115	0.145
AUGUST	0.110	0.135
SEPTEMBER	0.090	0.120
OCTOBER	0.050	0.090
NOVEMBER	0.055	0.090
DECEMBER	0.065	0.090

TABLE 5: Production of PET Flake from Bottles in 2015

Recycled PET (RPET) Production Summary (MMlbs)

- A. RPET Produced by US Reclaimers from US Bottles
- B. RPET Produced by US Reclaimers from Imported Bottles
- C. Total RPET Production US Reclaimers (A+B)**
- D. Clean Flake Equivalent from US Bottles Exported
- E. Total Clean Flake Produced from Bottles in US (A+D)**

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
A.	496	438	486	513	457	476	476	401	412	505	558	523	496	477	477	558	590	785	974	971	1,001
B.	38	70	55	75	47	51	44	46	49	83	85	69	82	87	84	71	77	84	107	139	69
C.	534	508	541	588	504	527	520	447	461	588	643	592	578	564	561	629	667	869	1,081	1,110	1,070
D.	153	134	92	75	154	143	184	212	255	298	401	529	583	647	601	557	462	396	327	291	296
E.	622	572	578	588	611	619	660	613	667	803	959	1,052	1,079	1,124	1,078	1,115	1,052	1,181	1,301	1,262	1,297

TABLE 7: PET Utilization Rate

Year	Clean Flake Equivalent from Bottle Material (MMlbs)	Bottles on US Shelves (MMlbs)	Utilization Rate
1995	622	1,950	31.9%
1996	572	2,198	26.0%
1997	578	2,551	22.7%
1998	588	3,006	19.6%
1999	611	3,250	18.8%
2000	619	3,445	18.0%
2001	660	3,768	17.5%
2002	613	4,007	15.3%
2003	667	4,292	15.5%
2004	803	4,637	17.3%
2005	959	5,075	18.9%
2006	1,052	5,424	19.4%
2007	1,079	5,683	19.0%
2008	1,124	5,366	20.9%
2009	1,078	5,149	20.9%
2010	1,115	5,350	20.8%
2011	1,052	5,478	19.2%
2012	1,181	5,586	21.1%
2013	1,301	5,764	22.6%
2014	1,262	5,849	21.6%
2015	1,297	5,971	21.7%

TABLE 8: RPET used by Product Category (MMlbs)

Product Category	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011 ¹	2012	2013 ²	2014	2015
Fiber	292	320	415	417	452	435	344	296	479	463	422	383	391	344	381	398	512	558	638	535
Sheet & Film	69	71	89	68	65	37	18	32	58	71	74	128	153	159	195	202	307	315	365	347
Strapping	66	58	67	80	101	82	83	77	116	131	132	144	137	114	127	120	136	140	126	106
Engineered Resin	24	26	30	26	27	24	10	10	12	8	9	11	7	10	9	See Other	See Other	See Other	See Other	See Other
Food & Beverage Bottles	24	41	52	68	54	77	86	106	126	115	139	136	141	203	216	242	276	425	351	350
Non-Food Bottles	71	53	47	50	40	44	43	24	63	63	49	60	55	65	58	57	50	50	57	60
Other	1	1	7	9	5	2	4	7	24	13	30	38	31	42	16	21	31	25	27	23
TOTAL CONVERTER CONSUMPTION	547	570	707	718	744	701	588	552	878	864	855	900	915	937	1,002	1,040	1,312	1,513	1,564	1,421

¹ The Engineered Resins category was folded into “Other” as there was insufficient survey response in this category to meet standard confidentiality guidelines.

² The Food & Beverage and Non-Food Bottles converter consumption volume splits for 2013 have been corrected to reflect a data error discovered in 2014. Total converter consumption volume for 2013 was not affected.