Zero Waste Maryland

Maryland's Plan to Reduce, Reuse and Recycle Nearly All Waste Generated in Maryland by 2040

December 2014

Martin O'Malley, Governor **Anthony Brown, Lt. Governor**

MARYLAND DEPARTMENT OF THE ENVIRONMENT
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Robert M. Summers, Ph.D., Secretary

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Executive Summary

Zero waste is an ambitious, long-term goal to nearly eliminate the need for disposal of solid waste and to maximize the amount of treated wastewater that is beneficially reused. It involves rethinking the way products are designed in order to prevent or reduce waste before it ever occurs. Discards that cannot be avoided should be designed for efficient recovery through recycling. Throughout their lifecycles, materials should be used and managed in ways that preserve their value, minimize their environmental impacts, and conserve natural resources. Ultimately, products that cannot be redesigned or recycled should be replaced with alternatives. Zero waste goals are intended to be challenging and to require comprehensive action.

In 2012, the total reported waste generated in Maryland included more than 12.3 million tons of solid waste and 211 billion gallons of municipal wastewater. Due to limitations in reporting mandates, the solid waste figure omits some materials, such as agricultural wastes. Maryland calculates recycling rates each year based on a subset of solid waste referred to as Maryland Recycling Act (MRA) waste, which is comprised primarily of municipal solid waste (MSW). MSW consists of everyday items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. MSW comes from our homes, schools, hospitals, and businesses. The MRA requires all counties and Baltimore City to recycle 15% (populations under 150,000) or 20% (populations over 150,000) of waste generated. State government is required to recycle 30% of its solid waste. In 2012, Maryland recycled 45.4% of MRA waste. Recycling in Maryland has made significant progress over the past two decades; in 1992 (the first year for which data is available), the recycling rate was just 19%.

However, Marylanders generate significantly more MSW per person than the U.S. as a whole, and continue to dispose of more than half the solid waste they generate, the majority of this in landfills. For some materials, such as food scraps, progress in diverting waste from landfills has been slow or stagnant. In addition, a variety of challenges have emerged over the past decade – population growth, land use changes, climate change, energy and transportation costs, fluctuation in markets for recyclable materials, and a lack of sustainable funding for solid waste programs exacerbated by global recession. These factors have impacted recycling programs and policies in recent years. Moreover, as Maryland achieves higher levels of waste diversion, the remaining materials will increasingly be those for which simple solutions are not available.

The State also faces challenges in increasing water conservation and reuse. In Maryland, some treated municipal wastewater effluent is beneficially reused, including for cooling at power plants and for irrigation. This practice is increasing slowly, but the level of reuse relative to the amount of wastewater generated is low (1.5%) and there are currently inadequate incentives to use reclaimed water. Reuse on site within individual businesses and residences is often complicated or precluded by local plumbing and other requirements.

These challenges require a new and more comprehensive approach to materials management. The principles of zero waste provide the framework for Maryland's path forward through the year 2040. This Plan seeks to broaden the State's focus on recycling of MRA materials to increase emphasis on source reduction and reuse and to address the full waste stream.

As part of its legislatively mandated Green House Gas Reduction Plan, the State has established long-term recycling and waste diversion goals of 80% and 85%, respectively, along with interim targets, depicted below in Table ES-1. Recycling rate goals for food scraps and yard trimmings are also included, as it is expected that composting and anaerobic digestion of organic materials will contribute a large portion of the additional recycling needed to meet the overall goals.

Table ES-1: Maryland's Zero Waste Goals

	2015	2020	2025	2030	2040
Overall Waste Diversion Goal	54%	65%	70%	75%	85%
Overall Recycling Goal	50%	60%	65%	70%	80%
Recycling Goal, Food Scraps	15%	35%	60%	70%	90%
Recycling Goal, Yard Trimmings	73%	76%	80%	83%	90%
Water Reuse	2%	7%	15%	25%	40%

Implementation of zero waste strategies yields considerable benefits, including GHG emissions reductions, energy savings, extended landfill capacity, addition of green jobs to the economy, conservation of natural resources, and avoidance of landfill disposal costs.

The initiatives proposed to achieve the zero waste goals are separated into the following four timeframes:

- Currently underway;
- 2015 – 2020;
- 2021 – 2025; and
- 2026 - 2030

The following table, ES-2, lists each of the initiatives, which fall within 8 broad objectives.

Table ES-2: Summary of Zero Waste Initiatives

	Initiative	Timeframe
Objective 1 – Increase Source Reduction and Reuse		
1.1	Study and update source reduction credits by 2016	2015 – 2020
1.2	Conduct a source reduction outreach campaign directed at consumers	2015 – 2020
1.3	Provide source reduction technical assistance to businesses	2015 – 2020
1.4	Ensure EPR systems are designed to encourage source reduction	2015 – 2020
1.5	Increase water Conservation	2015 – 2020
1.6	Increase water Reuse	2015 – 2020
1.7	Organize waste Exchanges	2021 – 2025
1.8	Research methods of encouraging sustainable product design	2026 – 2030
Objective 2 – Increase Recycling Access and Participation		

2.1	Increase mandatory county recycling rates	Underway
2.2	Implement multifamily recycling	Underway
2.3	Quantify the level of business recycling	2015 – 2020
2.4	Address away-from-home and event recycling	2015 – 2020
2.5	Phase in disposal bans on recyclables	2015 – 2020
2.6	Encourage pay-as-you-throw (PAYT)	2015 – 2020
2.7	Support extended producer responsibility for packaging	2015 – 2020
2.8	Consider further increases in minimum county recycling and maximum county disposal rates	2015 – 2020
2.9	Boost reuse and recycling of construction and demolition debris	2015 - 2020
2.10	Adopt universal recycling	2026 – 2030
Objective 3 – Increase Diversion of Organics		
3.1	Finalize and implement new composting regulations	Underway
3.2	Publish composting facility guidance	2015 – 2020
3.3	Encourage food donation	2015 – 2020
3.4	Launch an education and outreach campaign targeted to organics	2015 – 2020
3.5	Promote compost use in a wide variety of applications	2015 - 2020
3.6	Phase in a disposal ban on commercial and institutional organics	2015 – 2020
3.7	Encourage anaerobic digestion	2015 – 2020
3.8	Decrease plastic bag usage for organics collection	2015 – 2020
3.9	Decrease disposal of sewage sludge	2015 – 2020
3.10	Institute universal organics diversion	2026 – 2030
Objective 4 – Address Specific Target Materials		
4.1	Conduct a waste sort	2015 – 2020
4.2	Adopt a disposal ban on electronics	2015 – 2020
4.3	Establish EPR programs for mattresses and other difficult-to-manage materials	2015 – 2020
4.4	Adopt a carryout bag reduction and recycling law	2015 – 2020
4.5	Adopt a beverage container recycling law	2015 – 2020
4.6	Study potential solutions for pharmaceuticals	2015 – 2020
4.7	Consider other disposal bans	2021 – 2025
4.8	Consider product bans for non-recyclable materials	2026 – 2030
Objective 5 – Incentivize Technology Innovation and Develop Markets		
5.1	Review regulatory requirements and provide guidance	2015 – 2020
5.2	Support waste diversion research	2015 – 2020
5.3	Initiate and fund demonstration projects	2015 – 2020
5.4	Establish a funding system for provision of financial incentives	2015 – 2020
5.5	Establish by 2018 financial incentives for new reuse and recycling facilities	2015 – 2020
5.6	Collaborate across agencies on business and market development	2015 – 2020
5.7	Incentivize adoption of new programs by local governments	2015 – 2020
Objective 6 – Recover Energy from Waste		
6.1	Assess and compare environmental impacts of disposal technologies	Underway
6.2	Encourage anaerobic digestion	2015 – 2020

6.3	Support gasification and other clean energy technologies	2015 – 2020
6.4	Utilize energy recovery for managing solid waste after maximum removal of recyclables	2015 – 2020
6.5	Cease permitting of additional municipal landfill capacity	2015 – 2020
Objective 7 – Collaborate and Lead by Example		
7.1	Increase environmentally preferable procurement and management of electronics	Underway
7.2	Fully implement environmentally preferable procurement specifications	Underway
7.3	Increase procurement and use of compost	2015 – 2020
7.4	Seek opportunities for regional collaboration	2015 – 2020
7.5	Create a State government source reduction checklist	2015 – 2020
7.6	Progressively phase in higher recycled content requirements for paper	2015 – 2020
7.7	Increase State government recycling rates	2015 – 2020
7.8	Markedly increase composting and anaerobic digestion of State government organic waste	2015 – 2020
Objective 8 – Conduct Education and Outreach		
8.1	Seek sustainable funding for outreach	2015 – 2020
8.2	Provide funding to local governments for outreach activities	2015 – 2020
8.3	Establish a zero waste business recognition program	2021 – 2025
8.4	Conduct outreach at schools	2021 – 2025
8.5	Conduct business recycling assistance	2021 – 2025

Chapter One: Background

Maryland's Waste Stream

Maryland's overall waste stream includes solid waste and wastewater, both of which can be broken down into a number of component waste streams. A comprehensive plan to reduce and divert waste will require the State to address each of these components. Maryland Department of the Environment ("MDE" or "The Department") has effective reporting systems for some types of materials, but it lacks sufficient data in other areas. This section describes the components of Maryland's waste stream, using the best data currently available to the Department. An ongoing goal in implementing this Plan will be to improve the accuracy and completeness of information on waste generation and management.

Reported Solid Waste Generation

Each year, Maryland's permitted solid waste acceptance facilities, including landfills, transfer stations, processing facilities, incinerators, and natural wood waste recycling facilities, submit information to the Department on the quantity of materials accepted and managed during the previous year. This includes waste that is accepted by one of these facilities before being sent out-of-State for management. Counties report annual recycling tonnages, as well as the amount of waste they dispose out-of-State that does not pass through a Maryland-permitted solid waste facility. These two sources are combined and adjusted to avoid double-counting, yielding the total reported solid waste generated in Maryland - 12,344,735 tons in 2012.

However, that figure underestimates the total solid waste stream. Materials that do not pass through a Maryland-permitted solid waste facility and are not otherwise reported by counties are omitted. This limitation primarily affects the following waste streams:

- Commercial or industrial wastes that are sent through a private hauler to another state for disposal or recycling, without first passing through a Maryland solid waste facility;
- Agricultural wastes that never pass through a solid waste facility, such as manure that is managed on the farm or transported directly to another location for land application; and
- Coal combustion byproducts that do not pass through a solid waste facility, such as those transported to another site for beneficial use (note, however, that these are reported under a separate mandate, discussed below).

Maryland Recycling Act Waste and Municipal Solid Waste

A subset of the total reported solid waste is Maryland Recycling Act (MRA) waste. The MRA dictates the method for calculating the counties' annual recycling rates and its scope is limited to materials in the "solid waste stream." This excludes various materials that were not typically disposed at the passage of the Act in 1988, including rubble, land clearing debris, and sewage sludge, among others.[1] In order to calculate the MRA recycling rate, an MRA waste generation

[1] Environment Article, §9-1701(q), Annotated Code of Maryland.

figure must also be used. MRA waste generation is composed of municipal solid waste (MSW) plus industrial waste not disposed of in private industrial landfills. In 2012, 6,559,725 tons of MRA waste was generated. Because the Department has detailed recycling data for MRA waste, this subset is typically used when tracking the status of waste diversion in Maryland. Unless stated otherwise, references to recycling, disposal, or waste generation in this Plan refer to MRA materials.

Within MRA waste, MSW is refuse from residential and commercial sources, as well as some institutional sources (e.g. waste from schools, but not medical waste). Figure 1 shows the makeup of MSW by material in the U.S.[2] Paper, food scraps, yard trimmings, and plastic are the most significant components of MSW, together composing almost 70% of the MSW stream.

Figure 1: Total MSW Generation by Material in the U.S., 2011

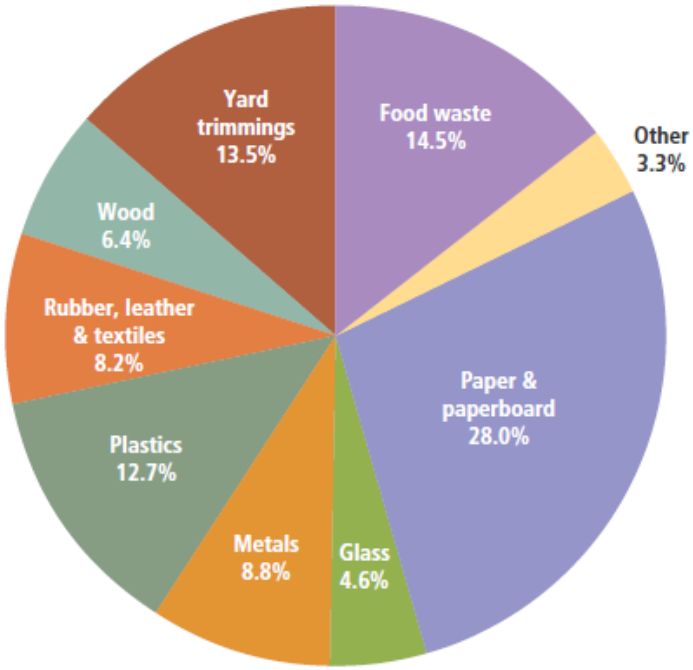


Figure 2 shows MRA waste generation from 1999 to 2012. Generation of waste has generally increased over that period, at an average of almost 4% per year, until a significant dip in 2008-2009 at the start of the recession. Since then, waste generation has not returned to pre-recession levels and actually dipped slightly in 2012.

There is some uncertainty about how to characterize the recent decreases in waste generation. Economic growth has long been considered a major driver of waste generation. However,

[2] The Department does not receive Maryland MSW generation information broken down by material (only recycling), so it currently relies on EPA's annual characterization of the U.S. MSW stream as a whole. EPA's 2011 report was the latest year available at the time MDE's 2012 annual recycling rate calculations were completed and is used throughout this Plan. EPA, Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2011, http://www.epa.gov/osw/nonhaz/municipal/pubs/MSWcharacterization_508_053113_fs.pdf.

evidence suggests that nationally, these two indicators may have started to decouple. Since the mid-1990's the gap has widened between some gauges of economic growth and the growth in waste generation in the U.S.[3] Waste generated per capita in the U.S. has slowed and fallen somewhat since the mid-2000's, well before the 2008 recession (the trend in Maryland has been more mixed, as discussed below). Some of this shift may reflect changes in technology that are likely to be permanent. Information is increasingly transmitted and viewed electronically rather than on paper. Innovations in product packaging have resulted in use of lighter (or simply less) material. These changes may result in lower waste tonnages, but also have the potential to impact the recyclability of the remaining waste stream. While population and economic growth are still likely to play important roles in waste generation over the planning period, it will also be important to monitor trends in waste composition and the recyclability of the waste stream.

Figure 2: MRA Waste Generated in Maryland, 1999 - 2012

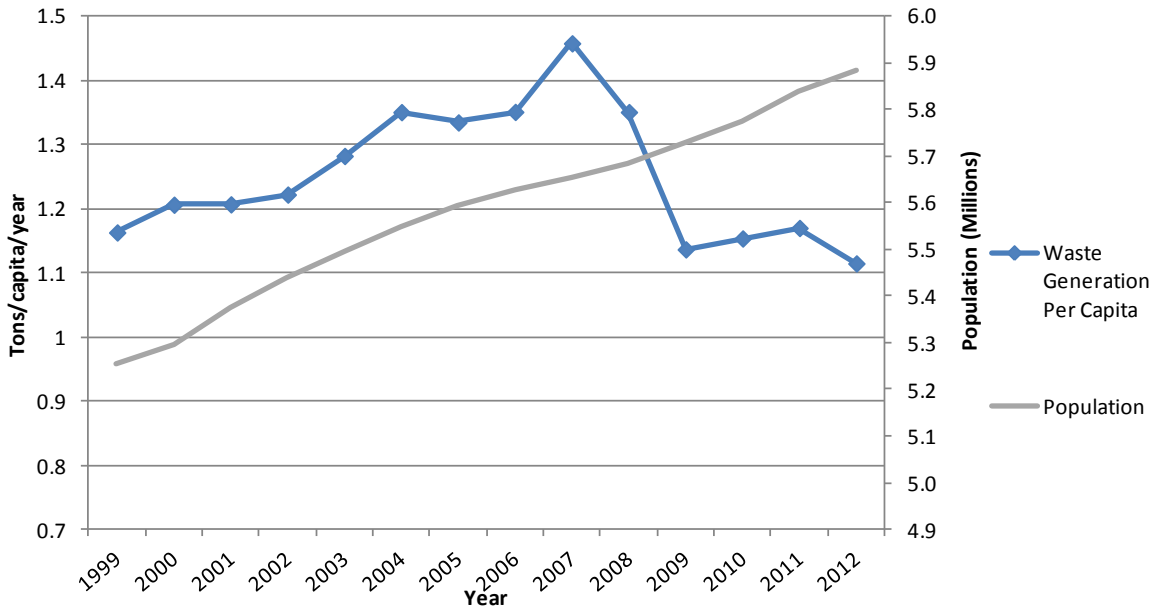
Figure 3 depicts per capita waste generation and population from 1999 to 2012. Maryland has experienced fairly steady population growth, averaging nearly 1% per year since 1999, although population growth slowed from 2006 to 2008.

In 2012, Maryland's per capita waste generation was 1.1 tons, or 6.11 pounds per person, per day. This was higher than EPA's 2011 estimate for the U.S. as a whole, at 4.4 pounds per

[3] EPA, Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012, http://www.epa.gov/osw/nonhaz/municipal/pubs/2012_msw_fs.pdf

person, per day in 2011,[4] suggesting that more emphasis should be placed on source reduction in Maryland.[5]

Figure 3: MRA Waste Generated Per Capita and Population, 1999 - 2012



Non-MRA Waste

Reported non-MRA waste includes construction and demolition debris (C & D), sewage sludge, land clearing debris, and industrial waste disposed in private industrial waste landfills. Table 1 shows the total reported waste generation, MRA waste generation, and non-MRA waste generation by county in 2012.

Table 1: Solid Waste Generated by County

County	Total Reported Solid Waste	MRA Waste	Non-MRA Waste
Allegany	610,140	95,605	514,535
Anne Arundel	1,126,947	653,829	473,118
Baltimore City	1,510,018	747,551	762,467
Baltimore County	1,956,546	1,014,621	941,925
Calvert	98,819	67,763	31,056

[4] EPA, Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2011, http://www.epa.gov/osw/nonhaz/municipal/pubs/MSWcharacterization_508_053113_fs.pdf

[5] Note that EPA's calculations omit certain materials that are included in Maryland's waste generation figure, such as all materials from industrial sources, retread tires, and reused pallets. When Maryland's generation figure is adjusted to omit these items, waste generation falls to 5.6 pounds per person, per day, which still exceeds the national figure.

Carroll	729,060	165,633	563,427
Cecil	154,586	102,327	52,259
Charles	690,423	152,632	537,791
Dorchester	67,122	38,996	28,126
Frederick	358,274	267,482	90,792
Garrett	51,750	42,115	9,635
Harford	418,251	273,892	144,359
Howard	631,774	482,332	149,442
Mid-Shore*	294,869	206,466	88,403
Montgomery	1,408,438	1,080,344	328,094
Prince George's	1,352,977	683,068	669,909
Somerset	36,843	21,643	15,200
St. Mary's	134,760	77,558	57,202
Washington	217,224	140,215	77,009
Wicomico	164,883	145,752	19,131
Worcester	157,574	99,900	57,674
State Highways	173,459	0	173,459
Total	**12,344,737**	**6,559,724**	**5,785,013**

* Mid-Shore includes Caroline, Kent, Queen Anne's and Talbot Counties.

Construction and Demolition Debris

A significant portion of non-MRA waste generated is believed to be C & D. Maryland-permitted solid waste facilities managed more than 2.1 million tons of Maryland-generated C & D in 2012. The Department does not receive information about C & D generation broken down by material, but C & D includes wood, metal, bricks, cement, glass, shingles and roofing, plaster, carpet, asphalt, insulation, pipes, wires, appliances, and materials from land-clearing associated with construction and demolition (soil, rock, brush, etc.). Smaller amounts of paper and dried paint may also be included. A 2006 California study characterizing C & D wastes found that roofing, concrete, asphalt, dirt and sand, and wood were the predominant components.[6]

Sewage Sludge

Maryland receives information on sewage sludge generation from the State's wastewater treatment plants. Table 2 shows the generation and management of sewage sludge in 2012. Maryland exports significant quantities of its sewage sludge – almost 46% of the 617,627 tons generated in 2012. The ultimate disposition of exported sewage sludge is not reported and is therefore unknown. However, of the sewage sludge that remains in-State, a relatively small portion is disposed, with significant use on agricultural land for its nutrient value.

One challenge in increasing diversion of sewage sludge from disposal is the need to prevent excess nutrients from polluting surface- and groundwater. In 2012, Maryland Department of Agriculture adopted revised nutrient management regulations and new guidelines for the

[6] CalRecycle, Targeted Statewide Waste Characterization Study: Detailed Characterization of Construction and Demolition Waste (2006), http://www.calrecycle.ca.gov/WasteChar/PubExtracts/34106007/ExecSummary.pdf

application of nutrients to agricultural land to protect water quality.[7] These guidelines include restrictions on the timing of nutrient applications. The timing restrictions will potentially increase the need for storage of nutrient sources, including sewage sludge. Increased costs associated with storage may make application on agricultural land more expensive relative to disposal, resulting in more disposal of sewage sludge.

Table 2: Sewage Sludge Generation and Management in 2012

	Tons	Percent of Total*
Exported	283,425	46%
Hauled to Another WWTP˜	121,674	20%
Stored	6,555	1%
Applied to Agricultural Land	107,486	17%
Applied to Marginal Land	8,768	1%
Distributed and Marketed	49,657	8%
Landfilled^	33,536	5%
Incinerated	6,526	1%
Total Generated in Maryland	**617,627**	**100%**

* Totals do not add due to rounding.
^ May include some use as landfill cover.
˜ "Hauled to another WWTP" means the sludge was taken to another plant in 2012 and incorporated into that plant's treatment process.

Coal Combustion Byproducts

Coal Combustion Byproducts (CCBs) are residuals of the process of burning coal for energy. CCBs can be disposed in surface impoundments or landfills or can be beneficially used in a variety of applications, including mine reclamation, structural fill applications or in the production of concrete.

The Department collects a fee from CCB generators on CCBs that are disposed in-State or transported out of State.[8] Generators of CCBs are therefore required to report tons of CCB generation each year. Table 3 depicts the generation of various types of CCBs in 2011. Figure 4 shows the disposition of CCBs in 2011. Eighty-one percent of CCBs were beneficially used or used for coal mine reclamation in 2011.[9]

Table 3: CCB Generation in 2011

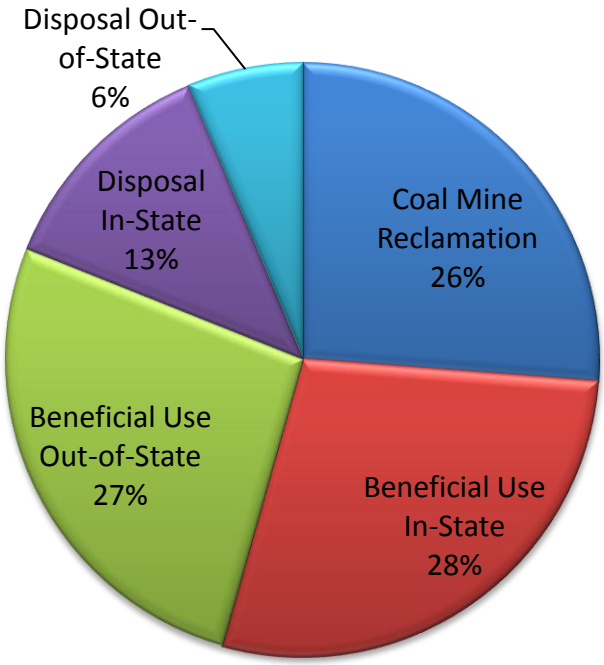
Type	Tons*
Bottom Ash	260,706

[7] COMAR 15.20.07.02; MDA, *Nutrient Management Manual*, Section 1.D., Nutrient Application Requirements (2012), http://mda.maryland.gov/resource_conservation/Documents/nm_manual/1-D1-1-1D1-6.pdf
[8] COMAR 26.04.10.09.
[9] MDE, 2011 Coal Combustion Byproducts Reports, http://mde.maryland.gov/programs/Land/SolidWaste/CoalCombustionByproducts/Pages/2011CCBGeneratorReports.aspx

Boiler Slag	17,730
Fly Ash	975,176
Slag Ash	6,903
Gypsum	525,562
Flue Gas Desulfurization Sludge	2,863
Wastewater Treatment Plant Fines	792
Total CCBs	**1,789,732**

*One company requested that its reporting be withheld from the 2011 annual report as a trade secret or confidential commercial information under the Public Information Act. As a result, these totals include all except one generator.

Figure 4: Disposition of CCBs in 2011*



*Includes materials stored in 2010 and used in 2011.

Agricultural Wastes

Agricultural wastes, which are generally not reported to the Department, include animal manure and bedding, crop residues, and animal mortalities. Maryland is a significant generator of agricultural wastes, particularly manure and bedding from poultry and horse farms, all of which is reused/recycled under a certified nutrient management plan.

Wastewater

Treated municipal wastewater is discharged from wastewater treatment plants to surface water or groundwater. In Maryland, approximately 570 million gallons per day (208 billion gallons per year) of municipal wastewater is discharged to surface water and 8.3 million gallons per day (3 billion gallons per year) is discharged to groundwater, for a total generation of 578.3 million gallons per day (211 billion gallons per year).

State of Waste Diversion and Management in Maryland

Maryland's solid waste is currently managed through a combination of recycling, composting, land-filling, energy recovery, and exporting for disposal or recycling. As discussed above, the Department calculates recycling and waste diversion rates according to the Maryland Recycling Act. The rates are derived from reports submitted annually by the counties. The waste diversion rate is the recycling rate plus a source reduction credit based on county responses to a source reduction checklist, up to a maximum of 5%.

In 2012, the State's recycling and waste diversion rates were 45.4% and 49.0%, respectively. Inclusion of non-MRA materials brings the recycling and waste diversion rates to 53.7% and 57.3%, respectively. Figure 5 below shows historical MRA recycling and waste diversion rates (where available) from 1992 through 2012.[10]

Maryland's recycling rate has generally increased since 1992, with periodic, temporary downturns that may correlate with economic cycles. Figure 6 shows the disposal and recycling tonnages in Maryland from 1999 to 2012. ("Disposed" means landfilled or used for energy recovery). Waste disposal peaked in 2004, and has generally declined since then as increases in recycling surpassed increases in waste generation. Waste disposal in 2012 was lower than in any year during the past 12 years, despite the fact that both population and waste generation have increased significantly during that period. Maryland recycles significantly more material per person than the U.S. average, at 2.8 pounds recycled per person, per day in 2012, compared with 1.2 pounds for the U.S. as a whole.[11]

Figure 5: Maryland Recycling and Waste Diversion Rates, 1992 - 2012

[10] The Department calculated waste diversion rates beginning in 2000.

[11] Using EPA's method of calculation, Maryland recycled 2.2 pounds per person, per day, still significantly higher than the national average.

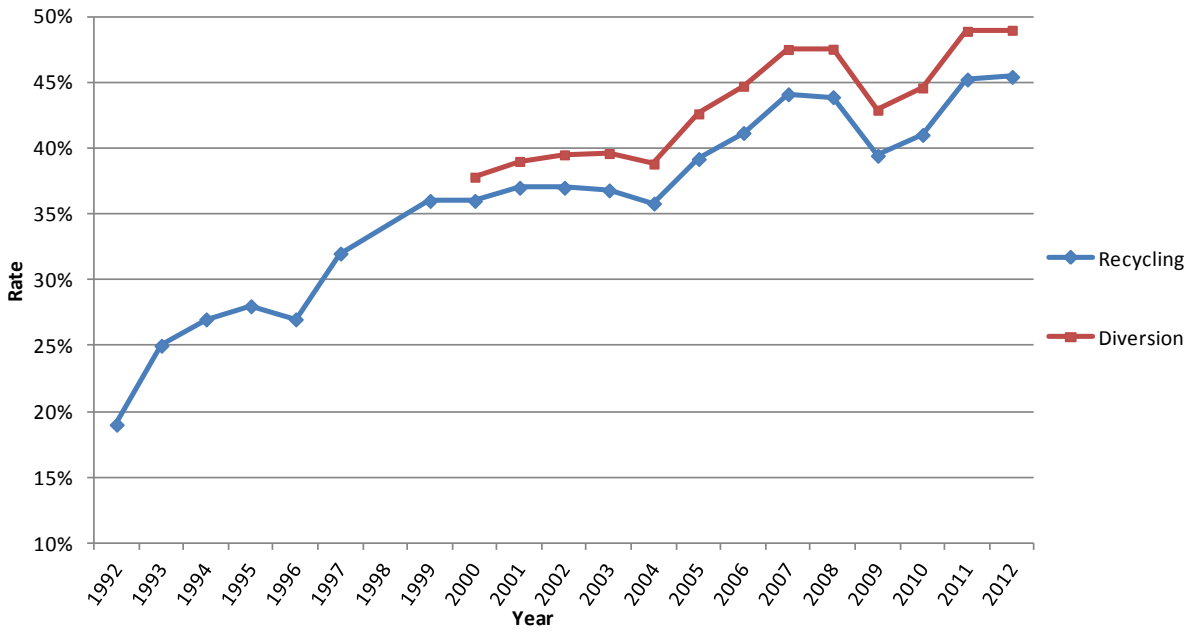
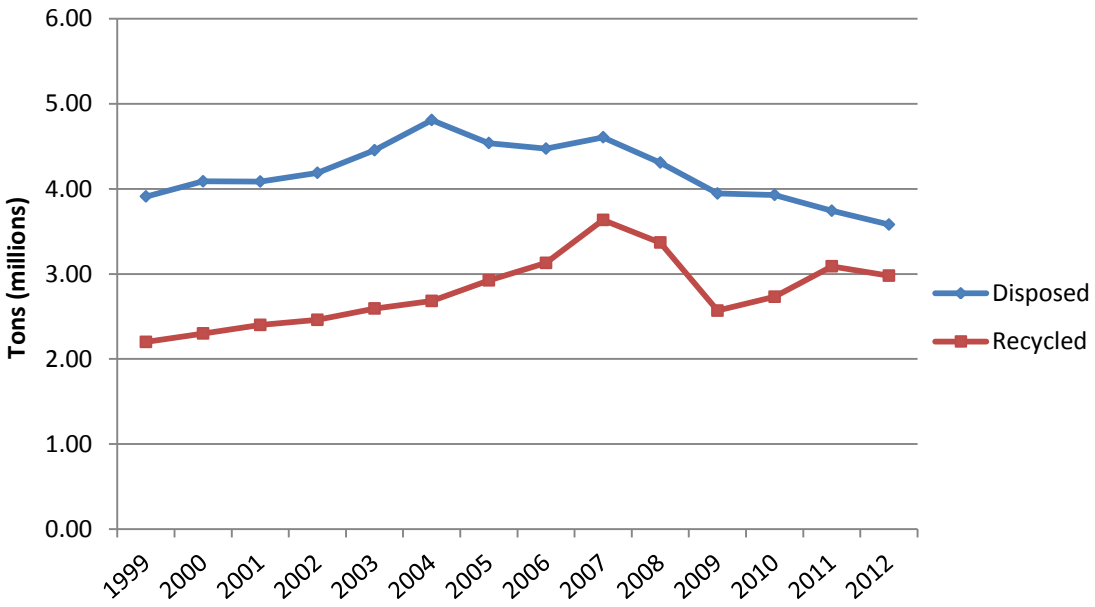
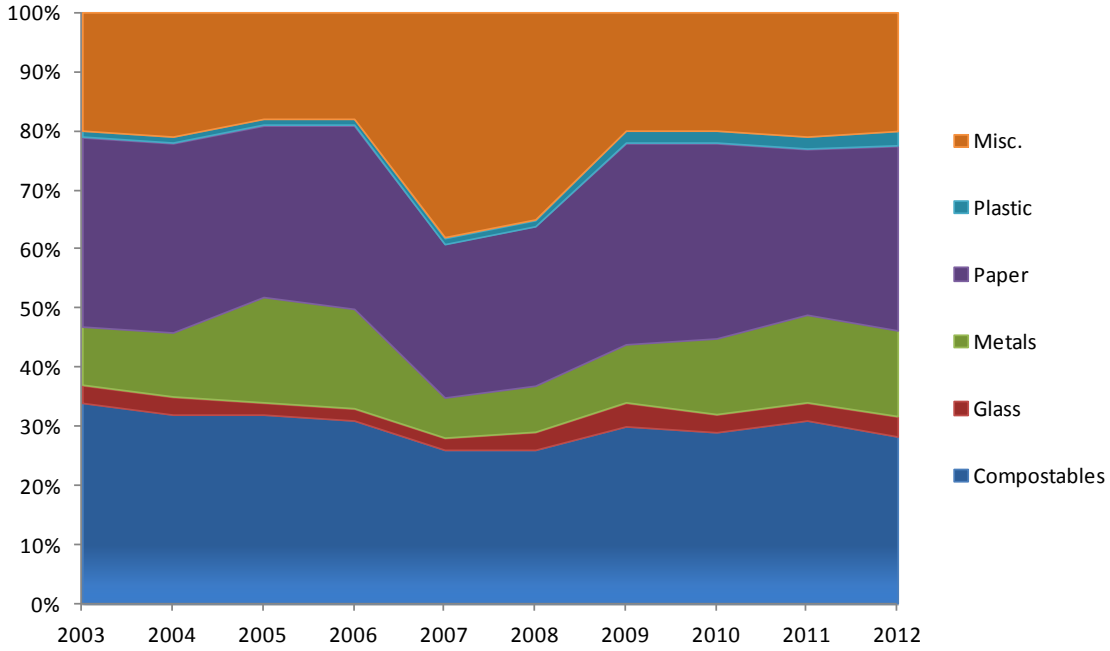


Figure 6: Tons Disposed and Recycled, 1999 - 2012



Of the MRA materials recycled in Maryland, compostable materials (primarily yard trimmings, with some food scraps) and paper consistently compose a large share. Figure 7 depicts the contribution of various materials to the total MRA tons recycled over time. The "miscellaneous" category is largely made up of municipal incinerator ash, but includes a variety of materials not included in the other categories.

Figure 7: MRA Materials Recycled, 2003 - 2012



Beginning in the 2013 reporting year, two important reporting changes will take place related to energy recovery. The first is that use of municipal incinerator ash as landfill alternate daily cover material (ADCM) will no longer be counted as recycling. Use of ash as ADCM was previously approved at one in-State landfill in Baltimore City. However, MDE documented problems with the performance of ash relative to traditional cover materials and has since disallowed its use.[12] As a result, use of ash as ADCM will no longer be counted as recycling. This applies even if the ash is sent for use at an out-of-State landfill, unless the state's environmental agency affirms the use as recycling. Recycling of ash for other purposes, such as for construction aggregate, will continue to be counted as recycling. All municipal incinerator ash reported as recycled in Maryland in 2012 was for ADCM, but some out-of-State ash recycling may have been for other purposes.

The second change is that beginning in 2013, counties that achieve at least a 5% reduction in the volume of the waste stream through an energy recovery facility in operation before 1988 will receive a 5% credit to their recycling rates. This credit has existed in the MRA since its adoption in 1988. However, in recent years counties have agreed to forgo the credit when ash recycling has exceeded the 5% credit. Now that use of ash as ADCM will no longer be counted as recycling, counties will resume claiming the 5% credit. Based on 2012 data, Anne Arundel, Baltimore, Harford, and Worcester Counties and Baltimore City are eligible for the credit.

If all ash recycling were eliminated, the 2012 recycling rate would have been 40.4%, a decrease of almost 5 percentage points. With the energy recovery credit, the 2012 recycling rate would have been 42.6%, a decrease of almost 3 percentage points.

[12] MDE may revisit this issue if a landfill operator provides documentation that demonstrates municipal incinerator ash performs as well as clean earth when used as ADCM. *See* COMAR 26.04.07.26A.

Table 4 below depicts Maryland's 2012 recycling rates for the four materials comprising the largest portions of the MSW stream. Material-specific recycling rates are estimated by using EPA data to calculate the quantity of each material generated in Maryland and comparing this to the actual recycling tonnages reported by counties.[13] This data shows that opportunities remain to capture considerable additional tonnage by implementing policies aimed at key materials, particularly paper, food scraps, and plastic. While the paper recycling rate exceeds Maryland's overall recycling rate, at 50.7%, it lags behind EPA's reported paper recycling rate for the U.S. of 65.6% in 2011.[14] Over one quarter of the waste disposed in Maryland each year is paper. Together, the four materials below made up almost 80% of all waste disposed in Maryland annually.

Table 4: Estimated Recycling Rates for Selected Materials, 2012

Material	Estimated Recycling Rate	Percent of Waste Stream	Tons Left to Capture	Percent of Waste Disposed
Yard Trimmings	70.9%	13.5%	256,805	7.2%
Food Scraps	8.5%	14.5%	870,435	24.3%
Paper	50.7%	28.0%	904,986	25.3%
Plastic	8.6%	12.7%	672,487	21.3%

In addition to EPA data, three counties (Montgomery, Anne Arundel, and Howard) have conducted recent waste composition studies on the *disposed* waste stream.[15] These can be used to supplement EPA data, though differences in methodologies prevent them from being directly compared.[16] The county studies generally support the information in Table 4 in that food scraps, paper, and plastic were significant components of waste disposed:

- Food scraps ranged from 23 – 29% of the waste disposed in Montgomery and Howard Counties (Anne Arundel did not include a separate food scraps category).
- Paper ranged from 11 – 26% of waste disposed in the three studies.
- Yard trimmings were 1 – 4% of waste disposed in the three studies.

[13] EPA's percentage of each material as a portion of the total waste generated in the U.S. is multiplied by the total tons of waste generated in Maryland to obtain the estimated tons of each material generated in Maryland. For example, EPA estimates food scraps are 36.31 million tons out of a total 250.42 million tons generated in the U.S. (36.31/250.42) x 6,559,724.78 = 951,136.52 estimated tons of food scraps generated in Maryland. Based on the counties' MRA reports, 80,701.62 tons of food scraps were recycled in Maryland. The food scrap recycling rate is therefore estimated as 80,701.62/951,136.52 = 8.5%.

[14] EPA, Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2011, http://www.epa.gov/osw/nonhaz/municipal/pubs/MSWcharacterization_508_053113_fs.pdf

[15] MSW Consultants, Howard County Maryland, Waste Composition Analysis of Residential Food Scrap Collection Pilot Program Draft Report (Prepared for Howard County) (2012); SCS Engineers, Waste Composition Study Summary of Results (Prepared for Anne Arundel County) (2010); SCS Engineers, Montgomery County Waste Composition Study Summary of Results (Prepared for Montgomery County) (2013), https://www.montgomerycountymd.gov/sws/resources/files/studies/waste-composition-study-130726.pdf

[16] The Anne Arundel and Howard County studies included only residential waste, while EPA includes all MSW. All three studies included only waste sent for disposal rather than the entire waste stream, so any differences between county and EPA data could be explained by either differences in generation or differences in recycling (or both). Finally, the three studies each used different categories for the material breakdowns.

- Plastic was 17% of waste disposed in Montgomery County (the other two counties did not include a separate category for plastics).

Recycling of non-MRA materials is tracked separately. MDE collects information on recycling of non-MRA materials from the counties on a voluntary basis, but because recycling of these materials does not count toward compliance with mandatory MRA recycling rates, not all counties submit complete information. As a result, the available data underestimates non-MRA recycling activities. Table 5 summarizes the non-MRA recycling reported in 2012.

Table 5: Recycling of Non-MRA Materials in Tons, 2012

Material	Reported Recycling (Tons)
Antifreeze	3,675
Asphalt & Concrete	1,073,285
Coal Ash	860,864
Construction/Demolition Debris	340,930
Land Clearing Debris	72,482
Scrap Automobiles	116,495
Scrap and Other Metal	578,140
Sewage Sludge[17]	142,433
Soils	399,164
Waste Oil	27,985
Other Materials	42,650
Total	**3,658,103**

In summary, the current and historical data shows that while there are a number of notable opportunities for improvement, Maryland is making steady progress in terms of increasing recycling and reducing disposal of solid waste. However, the State's relatively high per capita waste generation rate and the upward trend in total waste generation make source reduction critically important moving forward. Finally, a decline in recycling, waste diversion, and waste generation rates in 2008 and 2009 shows that these indicators are sensitive to economic and technological conditions and periodic fluctuations should be expected in the future.

Use of Reclaimed Water

Reclaimed water is domestic, municipal or industrial wastewater that is treated to remove impurities and is suitable for beneficial reuse. Rather than discharging treated municipal wastewater from wastewater treatment plants (WWTP) to surface water, water can be reclaimed and used for a variety of purposes. These uses include cooling, such as at power plants or data centers, and irrigation at farms, athletic fields, parks, playgrounds, golf courses, highway

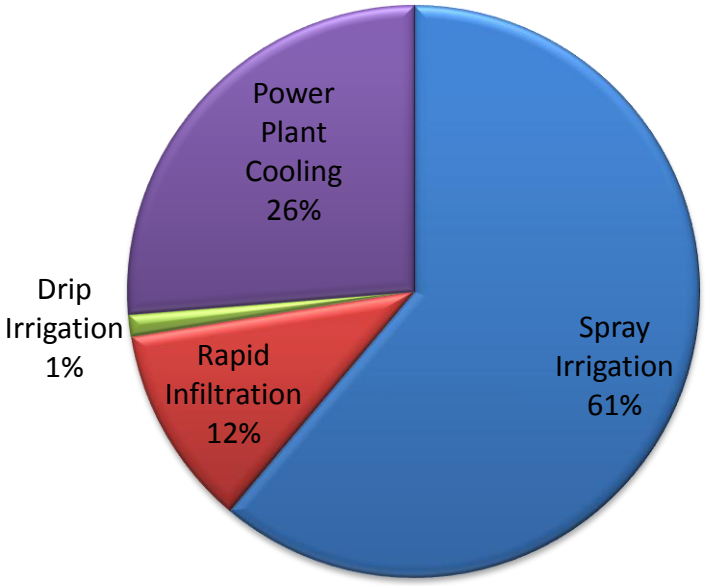
[17] The sewage sludge recycling tonnage in Table 5 is the quantity of sewage sludge recycling reported voluntarily by the counties. This varies somewhat from Table 2, which includes more detailed information required to be reported by generators of sewage sludge (wastewater treatment plants). Because the reporting used for Table 2 is mandatory and more detailed, it likely represents more complete information on sewage sludge than the quantity in Table 5.

landscaping areas, cemeteries, and similar locations. Land application of treated municipal wastewater can also be used to recharge groundwater.

Section 9-303.1 of the Environment Article states that the "Department shall encourage the use of reclaimed water as an alternative to discharging wastewater effluent into the surface waters of the State." The Department has established guidelines for land application and reuse of treated municipal wastewater.[18]

As of 2014, uses of reclaimed water in Maryland include 35 spray irrigation systems (nine of which are at golf courses), four rapid infiltration systems, three drip irrigation systems, and two power plant cooling systems. Together, these uses total 8.8 million gallons per day. Figure 8 shows the breakdown the total water reuse quantity by activity.

Figure 8: Types of Water Reuse in Maryland



While water reuse has increased in recent years, Maryland reuses only 1.5% of the total daily flow of municipal wastewater. In comparison, Florida, the leading state for water reuse, used 725 million gallons per day of reclaimed water in 2012. The total WWTP flow for that year was 1,599 million gallons, making Florida's reuse rate 45%.[19]

The Department expects two additional water reuse projects to be placed in service between 2015 and 2020: one power plant and one federal government data center.

Current Statutory Recycling Requirements

[18] MDE, *Guidelines for Land Application/Reuse of Treated Municipal Wastewaters*, MDE-WMA-001-04/10, http://www.mde.state.md.us/assets/document/MDE-WMA-001%20(land-treatment%20Guidelines).pdf
[19] Florida DEP, 2012 Reuse Inventory (2013), p. 3 http://www.dep.state.fl.us/water/reuse/docs/inventory/2012_reuse-report.pdf

The cornerstone of Maryland's current solid waste diversion policy is the Maryland Recycling Act, which defines and sets goals for recycling for all counties in the State (including Baltimore City). Counties are required to develop and periodically update recycling and solid waste management plans in order to meet the recycling goals.[20] The Department is responsible for reviewing and approving these plans and for regulating solid waste facilities. However, the counties, rather than the State, have direct responsibility for carrying out recycling and solid waste programs within their jurisdictions. In 2012, the Maryland Recycling Act was strengthened with the passage of Chapter 692, Acts of 2012, which increased mandatory and voluntary recycling rates for the counties and the State as a whole, as shown in Table 6 below.

Table 6: Recycling and Waste Diversion Goals, Chapter 692, Acts of 2012

Goal or Mandate	Current Rate	Increased Rate
Recycling rate, counties < 150,000 population	15%	20%
Recycling rate, counties > 150,000 population	20%	35%
Recycling rate, State government	20%	30%

By December 2015, counties must fully implement their plans to meet the increased rates. The new State government rate became effective July 1, 2014. The 2012 legislation also set voluntary Statewide recycling and waste diversion goals of 55% and 60%, respectively, by 2020. Table 7 shows the current recycling rates for each county, along with the rate that will be required of each county beginning in December 2015 (according to population projections for 2015).[21] As of 2012, most counties were already meeting the mandatory rates projected for December 2015.

Table 7: Current County Recycling Rates and Future Mandatory Rates

County	2012 Recycling Rate	Recycling Rate Required After December 2015
Allegany	30.6%	20%
Anne Arundel	45.9%	35%
Baltimore City	29.7%	35%
Baltimore County	41.5%	35%
Calvert	45.1%	20%
Carroll	36.9%	35%
Cecil	37.2%	20%
Charles	49.2%	35%
Dorchester	21.2%	20%
Frederick	46.7%	35%
Garrett	46.8%	20%
Harford	54.8%	35%
Howard	46.8%	35%
Mid-Shore*	52.7%	20%

[20] Environment Article, §§9-505; 9-1703, Annotated Code of Maryland.
[21] Maryland Department of Planning, Historical and Projected Total Population for Maryland's Jurisdictions (Mar 2012), http://www.mdp.state.md.us/msdc/popproj/Population_March27_2012.pdf

Montgomery	54.8%	35%
Prince George's	55.4%	35%
Somerset	17.1%	20%
St. Mary's	34.8%	20%
Washington	55.1%	35%
Wicomico	39.2%	20%
Worcester	29.3%	20%

* Mid-Shore includes Caroline, Kent, Queen Anne's, and Talbot Counties.

Challenges

Maryland is well positioned to move toward zero waste. As discussed in this chapter, Maryland is a leader in waste diversion. Historical trends suggest that recycling and waste diversion rates will continue to increase in the future, leading to reductions in disposal. A number of recent legislative and regulatory developments will come into full effect over the next two years, helping to improve county recycling rates, increase multi-family recycling opportunities, and site or expand composting facilities. Maryland counties and municipalities, as resources allow, are continually exploring and piloting new services, including mixed organics collection and acceptance of additional materials for recycling. However, Maryland also faces a number of challenges in achieving zero waste. The following are four important challenges that should be considered in implementing the initiatives in this Plan.

Reducing Reliance on Landfills

Maryland ranks among the most densely populated states in the U.S and is projected to grow by nearly another 1 million people by 2040.[22] Per capita personal income is projected to increase by nearly 30% over the same period, which may lead to increases in consumption and waste generation, exerting pressure on existing landfill capacity.[23] At the same time, as communities expand to accommodate population growth, efforts to site new or expanded landfills are likely to encounter public opposition and trigger zoning and land use disputes.

However, reducing Maryland's reliance on landfills faces significant challenges. Of the 24 permitted MSW landfills in Maryland, 22 are owned by local governments. (One is federally owned and one is privately owned.) Construction of a landfill requires a capital investment, which, in the case of a local government, may be funded by tax revenues or bonds. Over time, the landfill generates revenue through "tipping" fees charged on each ton of waste brought to the facility for disposal. Tipping fees enable local governments to recoup some of the costs associated with operation of the landfills and administration of solid waste and recycling

[22] Maryland Department of Planning, Historical and Projected Total Population for Maryland's Jurisdictions (2012) http://www.mdp.state.md.us/msdc/popproj/Population_March27_2012.pdf. Maryland was the 7th most densely populated state according to the 2010 Census, U.S. Census Bureau, https://www.census.gov/2010census/data/apportionment-dens-text.php

[23] Projected increase of 30.2% is from 2015 to 2040. Maryland Department of Planning, Historical and Projected Per Capita Personal Income for Maryland's Jurisdictions, http://www.mdp.state.md.us/msdc/projection/income/PerCapita_PI_March2014%20Revisions.pdf

programs. Tipping fees may also be used to repay principal and interest on bonds issued to fund construction of landfills.

Local governments rely on tipping fees generated throughout the full life of the landfill. Adoption of policies that eliminate or reduce the volume of waste sent to existing landfills also reduce the revenue stream upon which local governments depend. Adequate advance planning and the development of alternative financing mechanisms for solid waste and recycling programs are essential in moving toward increased waste diversion.

Table 8 below depicts the remaining capacity of existing MSW landfills in Maryland. Statewide, there is an estimated 36 years of remaining capacity at current disposal rates, not taking into account projected demographic or economic changes. The facilities highlighted in gray are projected to reach capacity within the period covered by this plan.

Table 8: Remaining Capacity of MSW Landfills in Maryland as of 2012

County	Municipal Landfill Facility Name	Remaining Capacity (Tons)	Year to Reach Capacity
Howard	Alpha Ridge Municipal Landfill	4,149,118	2050
Calvert	Appeal Municipal Landfill	1,311,550	2033
Dorchester	Beulah Sanitary Landfill	426,395	2017
Prince George's	Brown Station Road Landfill	3,648,161	2021
Cecil	Cecil County Central Landfill	1,272,941	2026
Worcester	Central Sanitary Landfill	1,934,011	2037
Charles	Charles County Municipal Landfill	2,034,353	2034
Baltimore County	Eastern Sanitary Landfill	5,125,000	2049
Frederick	Fort Detrick – Area B & Main Post	707,746	2333
Washington	Forty West Municipal Landfill	8,063,818	2109
Garrett	Garrett County Solid Waste & Recycling Facility	616,300	2034
Harford	Harford Waste Disposal Center	85,680	2017
Harford	Harford Waste Disposal Center (Expansion)	2,059,202	2028
Talbot	Midshore Regional Solid Waste Facility	126,246	2015
Caroline	Midshore II Regional Solid Waste Facility	4,433,502	2053
Anne Arundel	Millersville Landfill & Resource Recovery Facility	5,400,021	2041
Allegany	Mountainview Sanitary Landfill	515,919	2022
Wicomico	Newland Park Municipal Landfill	2,354,108	2038
Carroll	Northern Municipal Landfill	1,182,453	2059
Baltimore City	Quarantine Road Landfill	6,180,042	2026
Frederick	Reichs Ford/Site B Municipal Sanitary Landfill	2,084,129	2045
Somerset	Somerset County Landfill – Fairmount Site	381,279	2026

	Total	**54,841,974**	

(Two permitted facilities that do not currently dispose of waste were omitted from Table 8. Montgomery County Site 2's construction is on hold. St. Andrews Municipal Landfill was closed in 2001, but St. Mary's County now operates a transfer station under the permit.)

As landfills reach capacity and disposal rates decrease, consolidation of disposal facilities is likely. While the counties have typically operated separate landfills,[24] in the future the State may be adequately served by the smaller number of landfills with remaining capacity. Whether individual landfills choose to accept waste from other areas of the State will largely be a matter of local policy, however, as most landfills are run by county government.[25] Consideration of local governments' remaining principal and interest payments on capital investments in landfills will play a role in these decisions.

In 2014, the Maryland Association of Counties (MACo) surveyed counties on their outstanding landfill debt. In addition, MACo's annual Budget and Tax Rate Survey includes information on revenue from solid waste and recycling-related fees and service charges collected by the counties. The debt survey revealed a total of approximately $207 million in reported outstanding debt related to landfills and transfer stations, with most counties having at least some outstanding debt. Most jurisdictions will continue to have debt outstanding after 2020,[26] with some current debts persisting through least 2034. It is important to note that this survey represents a snapshot as of 2013 to 2014. Any projects undertaken in the near future may result in additional debt, lengthening the period for repayment. At least two counties reported that they expect to take on additional debt within the next several years. Another issue is that closure and post-closure of landfills requires additional expenditures; while some jurisdictions (Mid-Shore, Garrett, Harford and Somerset) included this in their reported debts, others may not have. Table 9 depicts the reported outstanding debt amounts by county.

Table 9: Reported Outstanding Landfill-Related Debt

County	Outstanding Debt*
Allegany	$419,000
Anne Arundel	$26,028,283
Baltimore City	$17,204,000
Baltimore County^	$25,789,158
Calvert	$241,528
Mid-Shore~	$22,615,000

[24] One notable exception is the Mid-Shore regional program, which encompasses Caroline, Kent, Queen Anne's, and Talbot Counties and operates 2 landfills in the State.

[25] For example, Montgomery County states that "as a matter of policy, County operated solid waste facilities are used only for solid waste generated in the County." Montgomery County Solid Waste Management Plan (2009), http://www.montgomerycountymd.gov/SWS/Resources/Files/swp/chapter3.pdf

[26] Twenty jurisdictions responded to the survey, with one jurisdiction, Mid-Shore, representing four counties (Caroline, Kent, Queen Anne's and Talbot.) Of these, at least 12 (Allegany, Anne Arundel, Baltimore County, Calvert, Mid-Shore, Carroll, Cecil, Frederick, Howard, Prince George's, Washington, and Wicomico) had debt retiring after 2020, and another four (Garrett, Harford, St. Mary's, and Somerset) did not provide complete information about debt retirement dates.

Carroll	$2,527,265
Cecil	$16,265,125
Charles	$0
Dorchester	Not reported
Frederick	$13,500,000
Garrett~	$4,484,325
Harford~	$2,151,159
Howard	$8,418,427
Montgomery	$0
Prince George's	$29,212,998
St. Mary's	$7,479,819
Somerset~	$8,705,961
Washington	$22,109,408
Wicomico	$190,000
Worcester	$0
Total	$207,341,456

*Excludes any debts reported as retiring prior FY 2014 and before.
^ Includes debt for transfer stations, which also generate tipping fees.
~ Includes closure or post-closure costs.

According to the Budget and Tax Rate Survey for FY 2014, the estimated total yield from all fees related to solid waste and recycling was $356 million.[27] Fee structures and uses for the revenue vary widely across jurisdictions. In addition to debt service, costs to staff and operate solid waste and recycling facilities, haul waste and recyclables, conduct education and outreach, clean up litter, and administer the programs may draw funding in whole or in part from fees on solid waste and recycling services. Table 10 includes the total revenue from solid waste and recycling fees by county.

Table 10: Total Yield from Solid Waste and Recycling Fees for FY 2014

County	Revenue
Allegany	$225,000
Anne Arundel	$49,779,900
Baltimore City	$9,450,000
Baltimore County	$1,900,000
Calvert	$10,723,662
Caroline*	$85,000
Carroll	$6,512,200
Cecil	$5,647,053
Charles	$10,117,500
Dorchester	$2,299,000

[27] MACo, FY 2014 Budget and Tax Rates Survey, http://md-mac.civicplus.com/index.aspx?nid=138

Frederick	$24,684,510
Garrett	$1,311,100
Harford	$12,544,650
Howard	$20,655,500
Kent*	$90,000
Montgomery	$94,684,740
Prince George's	$86,389,800
Queen Anne's*	$512,000
St. Mary's	$2,773,000
Somerset	$1,220,400
Talbot*	Not Reported
Washington	$5,536,320
Wicomico	$5,471,000
Worcester	$3,800,000
TOTAL	**$356,412,335**

*Part of Mid-Shore.

The State's ability to influence disposal methods is limited somewhat by Maryland's continuing status as a significant exporter of waste. An estimated 43% of MRA waste disposed in 2012 was exported for disposal.[28] Exportation of waste is affected by local solid waste collection systems and continuously changing economic conditions in- and out-of-State. Counties address collection of solid waste in several ways, including by providing waste collection themselves, contracting with private haulers for collection, and allowing haulers to contract directly with customers through private subscriptions (as is typically the case for non-residential waste).

In a publically-operated or publically-contracted system, the county may designate a certain facility as the disposal destination for all collected waste. In these systems, the county has control over whether waste exits the county or the State for disposal. However, private subscription haulers, nearly ubiquitous in the non-residential sector, are typically not subject to flow control and may freely export waste to other counties and States when economically advantageous. In addition, municipalities sometimes operate their own collection systems and may contract for out-of-State disposal.

The State does not have authority to regulate or prohibit out-of-State disposal transactions. As a result, decisions about exporting will continue to be localized economic decisions, often made by individual private haulers. Future exports will vary based on changes in tipping fees in Maryland and neighboring states, fuel costs, and any other factors affecting the price differential between in-State and out-of-State disposal. Virginia, which is Maryland's largest export destination for waste, is home to a number of large, privately operated regional landfills that accept Maryland

[28] 1,547,666 tons of MSW were exported for disposal in 2012. The MRA waste disposed in 2012 was 3,580,222 (1,547,666 ÷ 3,580,222 = .43). While the definitions of MSW and MRA waste vary slightly, they are sufficiently similar that this comparison presents the best available estimate of MRA exports for disposal.

waste; some of these landfills have extensive remaining capacity.[29] For these reasons, it is assumed in this Plan that the current proportion of exports (43% of disposal) will continue throughout the planning period. While it is believed that the majority of this disposal is currently in landfills, the exact proportion is unknown.

Regardless of whether materials are exported or managed in Maryland, the State strives to reduce over time the percentage of Maryland-generated waste that is landfilled, with an ultimate goal of 100% diversion from landfills by 2040.

Securing Sustainable Funding

Sustainable funding for recycling programs, particularly for outreach, education, and financial incentives, is necessary to implement this Plan. Innovative methods to divert materials require capital for new facilities and equipment. While grants and other financial incentives may be the most direct method of encouraging investment, they require a sustainable funding source. (See Appendix B for examples of incentives provided in other states and those states' funding mechanisms.)

However, obtaining sustainable funding is challenging for several reasons. In the U.S., recycling programs at the local and state level are often funded by fees on solid waste disposal and permitting. In Maryland, local governments have experienced reductions in revenue from tipping fees as recycling has increased and a large portion of disposal has been sent out of State. At the State level, the Department does not currently have authority to collect per-ton fees for solid waste disposal, nor does it collect annual or permitting fees for solid waste facilities. In this respect, Maryland is unique among its neighboring states, including Virginia, West Virginia, Pennsylvania, and Delaware.

Securing funding through other sources presents challenges as well. The impacts and benefits of outreach and education programs are sometimes difficult to measure or isolate, and are therefore difficult to articulate when justifying funding.

The Department, local governments, and other stakeholders have repeatedly recognized the need for long-term funding, including during the Solid Waste and Recycling Study Group (convened pursuant to Chapter 719, Acts of 2010) and the Composting Workgroup (convened pursuant to Chapter 363, Acts of 2011). However, no consensus across stakeholders has been reached. In 2004 and again during the 2010 Study Group, the Department discussed with stakeholders two potential options for long-term funding: permit fees and tipping fees. Local governments were concerned that State tipping fees levied at the point of in-State disposal would encourage haulers to take waste out of State, thus reducing revenue from county tipping fees. Fees on solid waste facility permits were generally perceived as the better of the two options, with the benefit of being more predictable across time. The Study Group recommended further evaluation of the

[29] *See* Virginia Waste Industries Association, Economic Impact of Virginia's Privately-Operated Landfills, Transfer Stations and Waste Hauling Companies, http://www.vwia.com/issues/economic-impact.php.; Virginia DEQ, Solid Waste Managed in Virginia During Calendar Year 2012, http://www.deq.virginia.gov/Portals/0/DEQ/Land/SolidWaste/2013_Annual_Solid_Waste_Report.pdf

two potential mechanisms for long-term funding. It also recommended a review of alternative options, including proposals for extended producer responsibility (EPR) for packaging and printed paper.

In recognition of the challenges of securing sustainable funding, a number of the initiatives proposed in this Plan are designed to be self-sustaining, including initiatives to encourage beverage container and carryout bag diversion and extended producer responsibility policies.[30] However, other important components will require the State to revisit the funding issue. The Department, local governments, members of the General Assembly, and other stakeholders will resume discussions about funding options as recommended in the Study Group's report, including permitting fees.

Increases in Waste Generation

The State's population is expected to increase by more than 1 million people by 2040. Source reduction efforts are needed to decouple waste generation from increases in population and economic growth. This is essential to capturing the environmental benefits envisioned in zero waste; even at very high recycling rates, significant quantities of waste will continue to be disposed unless waste generation is curtailed. Without a decrease in per capita waste generation, Maryland is projected to dispose of more than 1.7 million tons of waste in 2040, despite meeting an 80% recycling rate.

Complexity of the Lifecycle Approach

Broadening the focus to all lifecycle phases requires engagement across sectors, including producers, distributors, haulers, processors, purchasers of recycled materials, and consumers. Materials are likely to cross local, State, and even national borders multiple times throughout their lifetime. Increased collaboration and research will be needed to develop successful, cost-effective programs that account for the complexities of product lifecycles.

Challenges in Siting New Facilities

The Department's primary role in regulating facilities is to establish conditions that are adequately protective of the environment, given the activity being conducted and the characteristics of the site. The question of whether a location is appropriate for a particular type of activity at all is usually the province of the local government, which carries out this role through local zoning and land use planning. Local governments take into account not only the environmental impacts of particular activities, but their impacts on the other activities taking place around them. Often, public input in these decisions is encouraged and protected by local law.

[30] These policies are "self-sustaining" in that they incorporate funding mechanisms. In the case of extended producer responsibility and beverage container deposit laws, producers/distributors and consumers fund the program. In the case of carryout bag fees, consumers of carryout bags typically fund the program.

As stated above, Maryland is, overall, a densely populated state. Solid waste and recycling facilities can be very difficult to site in heavily populated areas due to concerns of surrounding landowners, even though populous areas are often the most in need of recycling and solid waste services. Opposition to facilities may be based on perceived economic, health, environmental, nuisance, or traffic-related impacts. Opposition may also be based on past examples of poorly managed facilities or even on misinformation about a particular activity. If Maryland is to support the growth in recycling capacity needed to reach zero waste, local and State governments must address negative perceptions about recycling activities. This can be accomplished by ensuring adequate environmental controls to prevent poor facility management and educating the public on recycling processes and their benefits. Education will be especially important for less familiar recycling technologies, such as anaerobic digestion.

Chapter Two: Maryland's Zero Waste Strategy

Definition of Zero Waste

Zero waste is an ambitious, long-term goal to nearly eliminate the need for disposal and to maximize the amount of treated wastewater that is beneficially reused. It involves rethinking the ways products are designed in order to prevent or reduce waste before it occurs. Discards that cannot be avoided should be designed for optimal recovery through recycling. Materials should be used and managed in ways that preserve their value, minimize their environmental impacts, and conserve natural resources. Products that cannot be redesigned or recycled should be replaced with alternatives. Zero waste goals are intended to be challenging and to require comprehensive action. Because achieving zero waste requires significant legislative and behavioral changes, zero waste objectives are usually mid- or long-range goals. As a result, existing zero waste plans in other jurisdictions tend to cover 10 to 40 year periods.

Zero waste calls for recasting issues of solid waste management and recycling more broadly, taking into account the entire lifecycle of each product. It requires decision-makers to prioritize methods of materials management in order to maximize the value recovered from each material. EPA's Solid Waste Management Hierarchies,[31] which establish a set of preferences in the management of materials, are good illustrations of zero waste principles. Two hierarchies adapted from the EPA versions are shown below in Figure 9 (for materials generally) and Figure 10 (for food scraps).

Figure 9: Materials Management Hierarchy

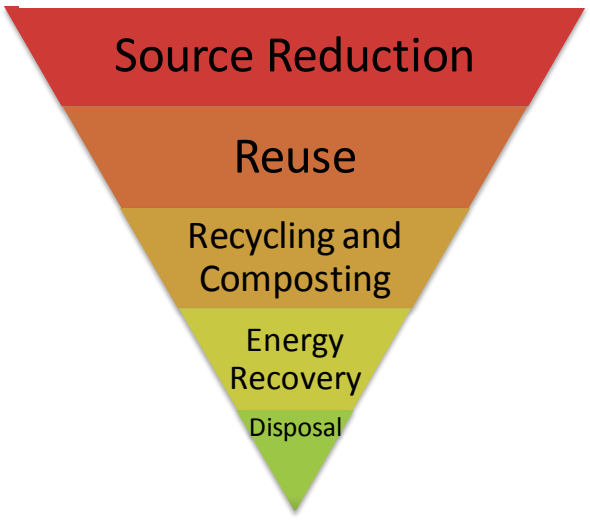
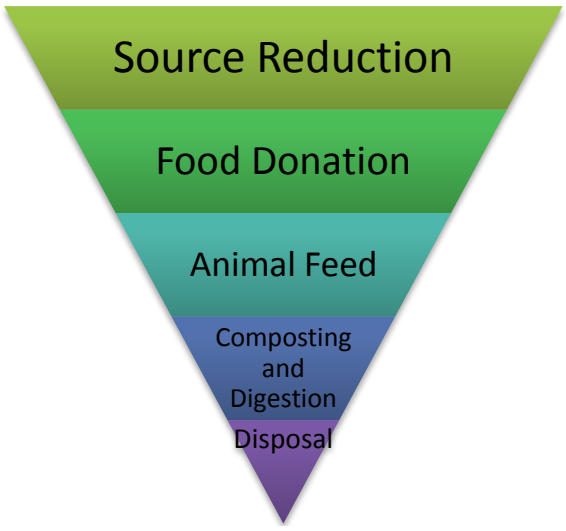


Figure 10: Food Management Hierarchy



[31] EPA, Solid Waste Management Hierarchy, http://www.epa.gov/wastes/nonhaz/municipal/hierarchy.htm

Maryland's Zero Waste Goals

The State has established long-term 2040 recycling and waste diversion goals of 80% and 85%, respectively, along with interim milestone targets, depicted below in Table 11. Recycling rates for food scraps and yard trimmings are also included, as it is expected that composting and anaerobic digestion of organic materials will contribute a large portion of the additional recycling needed to meet the overall goals. Finally, the zero waste goals include progressive targets to increase water reuse.

Table 11: Maryland's Zero Waste Goals

	2015	2020	2025	2030	2040
Overall Waste Diversion Goal	54%	65%	70%	75%	85%
Overall Recycling Goal	50%	60%	65%	70%	80%
Recycling Goal, Food Scraps	15%	35%	60%	70%	90%
Recycling Goal, Yard Trimmings	73%	76%	80%	83%	90%
Water Reuse	2%	7%	15%	25%	40%

These targets are high; no State in the country has yet achieved the 2040 recycling goals. Achievement of these goals is possible, however, if the legislation, regulations, outreach, incentives, and other policies described in this Action Plan are implemented. Each of the specific initiatives detailed in Chapter 3 has been successfully implemented in at least one jurisdiction in the U.S. or abroad.

For comparison purposes, Table 12 depicts recycling and waste diversion goals adopted by other jurisdictions. Methods of accounting for progress toward these goals vary widely across jurisdictions. Some of the goals account for materials other than MSW; Massachusetts, California, Delaware, and San Francisco include construction and demolition materials as well as municipal solid waste (MSW). Massachusetts also includes some types of industrial and medical waste, as well as sewage sludge. Washington, DC's goal for 80% waste diversion includes energy recovery. Use of materials as landfill cover is also characterized differently, with Massachusetts and San Francisco counting it as waste diversion.[32]

As discussed above, Maryland currently uses the Maryland Recycling Act framework to calculate recycling and diversion rates. MDE interprets the MRA to exclude from recycling waste-to-energy incineration, gasification, and similar technologies that destroy waste for energy generation.[33] The definition of recycling under the MRA requires that the recyclable materials

[32] Massachusetts' goal is based on a reduction in disposal tons. Use of C & D materials and some other non-MSW as landfill cover is counted as non-disposal for the purpose of this goal, however Massachusetts also calculates a recycling rate, which excludes these activities.

[33] Back-end scrap metal that is recovered from a waste-to-energy or gasification process and recycled is counted as recycling.

be "returned to the marketplace in the form of raw materials or products."[34] Anaerobic digestion is considered recycling if the digestate is returned to the market (e.g. as a soil amendment or as an input to a composting process). The MRA method is in line with U.S. EPA guidance on measuring recycling.[35]

However, since the MRA applies only to mandatory county recycling rates, the Department has more flexibility in determining how to measure recycling and waste diversion for zero waste purposes. As new practices in managing waste and recyclables develop, the Department will consider whether these fit within the overall zero waste concept of waste diversion. In addition, the Department intends to take a more comprehensive approach for the zero waste goals by seeking more complete waste generation and management information and tracking progress across the entire waste stream.

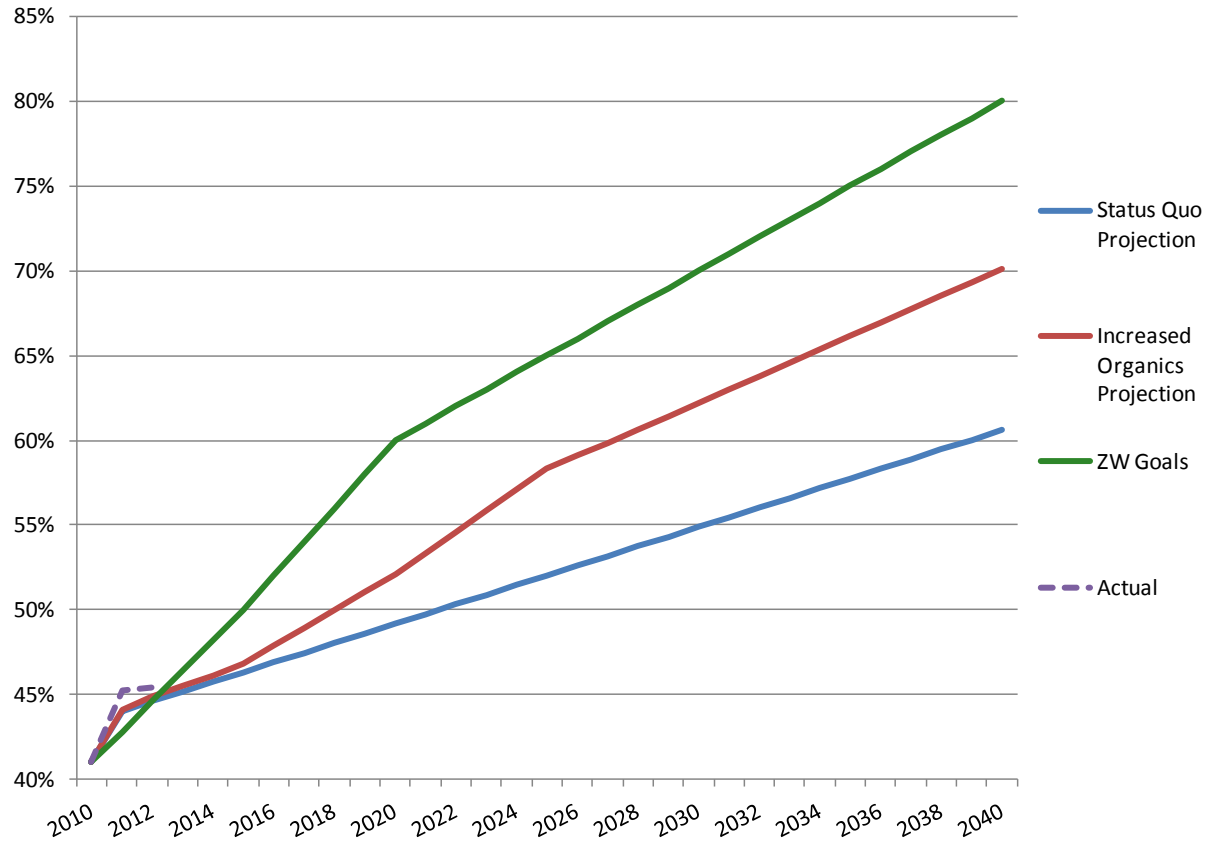
Table 12: Examples of Aggressive Waste Diversion Goals

Jurisdiction	Goal
Massachusetts[36]	2020: Reduce 2008 tons disposed by 30% 2050: Reduce 2008 tons disposed by 80%
Delaware[37]	2015: Recycling rate of 50% and diversion rate of 72% 2020: Recycling rate of 55% and diversion rate of 82%
California[38]	2020: Recycling rate of 75%
Washington, DC[39]	2032: Diversion rate of 80%. Send zero waste to landfills and reduce waste generated by 15%.
Austin, TX[40]	2015: Diversion rate of 50% 2020: Diversion rate of 75% 2025: Diversion rate of 85% 2030: Diversion rate of 90% 2040: Diversion rate of 95%
San Francisco, CA[41]	2020: Diversion rate of 100%
Seattle, WA[42]	2015: Recycling rate of 60% 2022: Recycling rate of 70%

[34] Environment Article, §9-1701(n)(1), Maryland Code.
[35] EPA, *Measuring Recycling, A Guide for State and Local Governments,* pp. 6, 53 (1997), http://www.epa.gov/waste/conserve/tools/recmeas/docs/guide.pdf
[36] Massachusetts DEP, Massachusetts 2010-2020 Solid Waste Master Plan (Apr 2013), http://www.mass.gov/eea/docs/dep/recycle/priorities/swmp13f.pdf
[37] Delaware Solid Waste Authority, Statewide Solid Waste Management Plan For Delaware (2010), http://www.dswa.com/pdfs/Statewide%20Solid%20Waste%20Mgmt%20PlanAdopted42210.pdf
[38] California Pub. Res. Code § 41780.02(a).
[39] Washington DC, Sustainable DC Plan, http://sustainable.dc.gov/sites/default/files/dc/sites/sustainable/page_content/attachments/DCS-008%20Report%20508.3j.pdf
[40] Austin Resource Recovery, Master Plan (Dec 15, 2011), http://www.austintexas.gov/sites/default/files/files/Trash_and_Recycling/MasterPlan_Final_12.30.pdf
[41] San Francisco Environment, Resolution No. 002-03-COE, Resolution Setting Zero Waste Date (Mar 6, 2003), http://www.sfenvironment.org/sites/default/files/editor-uploads/zero_waste/pdf/resolutionzerowastedate.pdf
[42] Seattle, Resolution 30990, Zero Waste Resolution (July 16, 2007), https://www.seattle.gov/util/groups/public/@spu/@garbage/documents/webcontent/02_015860.pdf

Figure 11 compares the zero waste goals with status quo projected recycling rates. (The status quo recycling rates were projected by calculating an average annual percent change in the recycling rate over the period from 2000 to 2010, then estimating the total expected change in the recycling rate from a base year of 2006.) The "increased organics" rate depicts the projected recycling rate for all materials except food scraps and yard trimmings, which would increase over time to the rates listed in Table 11. The graph demonstrates that increased organics recycling could close much of the gap necessary to meet the zero waste goals. The dashed line depicts the two years of actual data collected since the projections were made.

Figure 11: Recycling Rate Projections



Benefits of Better Waste Management

Expanding Business Opportunities and Sustaining More Jobs

Increased recycling generates employment. Research by the Institute for Local Self-Reliance, published in 2013, found that composting or mulching of organics employs more people on a per-ton basis than does incineration or land-filling. Composting yielded 4.1 jobs per 10,000 tons

of composted material, while land-filling yielded 2.1 jobs and incineration only 1.2 jobs.[43] A 2011 paper by the Natural Resources Defense Council concluded that if the entire U.S. were to achieve a waste diversion rate of 75% by 2030, it would result in more than 1.1 million additional jobs (counting direct jobs impacts only).[44] This is because disposal activities require relatively little labor, estimated at less than 0.1 job per 1,000 tons managed. NRDC estimated the following direct jobs impacts, per 1,000 tons of material, of selected recycling-related activities:

- Processing of recyclables: 2 jobs
- Processing of organics: 0.5 jobs
- Manufacturing paper, iron and steel using recycled materials: 4 jobs
- Manufacturing plastics using recycled materials: 10 jobs
- Reuse of metals: 20 jobs
- Reuse of glass: 7 jobs

Conserving Natural Resources and Saving Money

Recycling and source reduction conserves natural resources. For example, recycling one ton of paper conserves the equivalent of 17 trees and 7,000 gallons of water. Each ton of crushed glass that is recycled saves 1.2 tons of raw materials in the manufacturing of new glass.[45] Finally, recycling and source reduction result in cost savings by reducing disposal costs. The average tipping fee at Maryland landfills is $58 per ton. Recycling of MRA materials avoided nearly $173 million in tipping fees in 2012 or ($385 million if non-MRA materials are also included). Water reuse displaces the need for sources of potable water and replenishes groundwater sources. Increasing water reuse to 40% in Maryland could displace the need for 84 billion gallons of potable water annually.

Reducing GHG Emissions and Saving Energy

Implementation of zero waste strategies would yield a reduction of 4.8 $MMtCO_2e$ per year by 2020, relative to the 2006 baseline emissions[46], representing 8.6% of the total emission reductions needed to achieve a mandated 25% reduction in Statewide GHG emissions by 2020. In 2012, Maryland's recycling, source reduction, and composting activities reduced GHG emissions by more than 6.5 $MMtCO_2e$, relative to disposal. This is the equivalent of eliminating emissions from nearly 1.2 million passenger vehicles.

Recycling and source reduction save energy. In 2012, Maryland saved more than 53 trillion BTUs from recycling and source reduction, the equivalent of:

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[43] Institute for Local Self-Reliance, Composting Makes ene: Jobs through Composting & Compost Use, http://www.ilsr.org/composting-sense-tables/

[44] NRDC, *More Jobs, Less Pollution: Growing the Recycling Economy in the U.S.* (2011), http://docs.nrdc.org/globalwarming/files/glo_11111401a.pdf

[45] EPA, Communicating the Benefits of Recycling, http://www.epa.gov/osw/conserve/tools/localgov/benefits/#four ; CalRecycle, Glass Trivia and Facts, http://www.calrecycle.ca.gov/RecycleRex/RecyCoolClub/Newsletter/Glass/TriviaFacts.htm

[46] Maryland's Greenhouse Gas Reduction Act Plan (2013), http://climatechange.maryland.gov/site/assets/files/1392/mde_ggrp_report.pdf

- The annual energy consumption of more than 430,000 households
- The energy from nearly 8.4 million barrels of oil
- The energy from nearly 400 million gallons of gasoline

Conserving Landfill Capacity

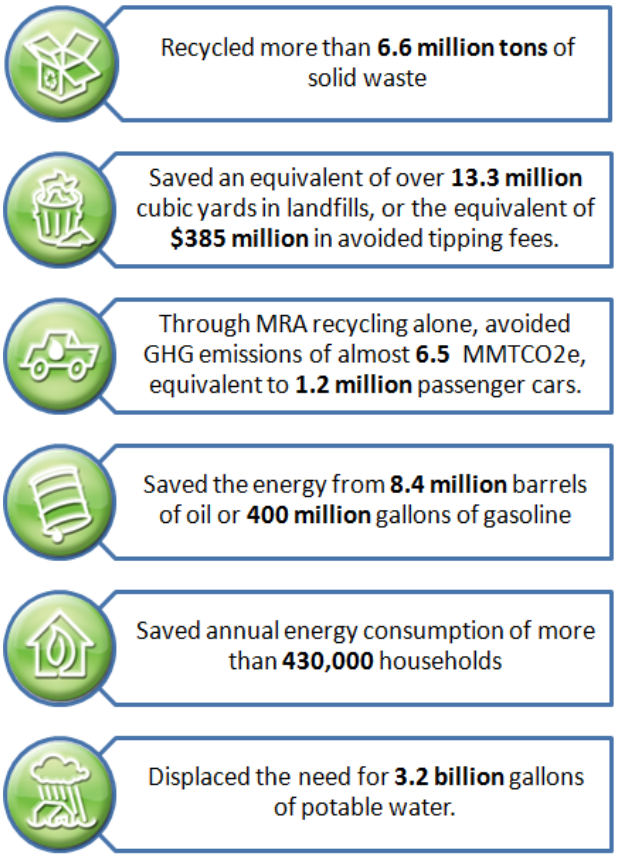
Achieving zero waste will also drastically reduce the amount of space needed for landfills. As of 2012, Maryland's MSW landfills had 36 years of remaining capacity. The 3.0 million tons of MRA materials recycled in 2012 saved an estimated 6.0 million cubic yards of landfill space.[47] Including non-MRA recyclables saves more than 13.3 million cubic yards (the volume of more than 4,000 Olympic-sized swimming pools).

Increasing Revenue

The expansion of business opportunities, job creation, and siting of new facilities to recycle and reuse waste leads to an overall economic boost to communities. State and local tax revenues and local permitting fees increase with expansions in recycling and reuse businesses. A 2006 South Carolina study, for example, found that for each 1,000 tons of recycled MSW, there was a total economic impact of $236,000, with additional state tax revenue of $3,687.[48]

Improving Health

Figure 12: Benefits of Waste Diversion in 2012



Better materials management reduces impacts to air and water, improving human health. While modern environmental regulations seek to prevent adverse health effects of production and disposal of products, it is unavoidable that these processes place some burdens on the environment. Waste diversion reduces the need for extraction of raw materials, energy production, and transportation. Ultimately, zero waste will result in a future with very little disposal. Risks of water and air pollution from land-filling and energy recovery will be minimized. Greenhouse gas emissions related to materials management will decrease, contributing to Maryland's broader goal of avoiding the harmful results of climate change. These include floods, heat waves, droughts, and severe storms, all of which have both direct and indirect impacts on health.

[47] EPA, Measuring Recycling, A Guide for State and Local Government (1997), http://www.epa.gov/wastes/conserve/tools/recmeas/docs/guide.pdf (One cubic yard in an average MSW landfill holds around 1,000 pounds (1/2 ton).

[48] Hefner, Frank and Calvin Blackwell, College of Charleston Department of Economics and Finance, The Economic Impact of the Recycling Industry in South Carolina (2006), http://www.epa.gov/solidwaste/conserve/tools/localgov/docs/economic-impact-of-recycling-sc.pdf

Chapter Three: Zero Waste Action Plan

This chapter lays out a series of suggested actions to move Maryland toward its zero waste goals. The actions are grouped into 8 broad objectives. In furtherance of each objective, near-, medium-, and long-term initiatives are identified in the following timeframes:

- Currently underway
- 2015 – 2020
- 2021 – 2025
- 2026 - 2030

A full list of the initiatives appears in the Executive Summary, Table ES-2.

Objective 1 – Increase Source Reduction and Reuse

Background

Source reduction and reuse, in that order, are the preferred methods of waste diversion. Source reduction involves changing the way products are designed, manufactured, purchased, or consumed in order to prevent excess waste, rather than managing it after it occurs. Reuse is using a product or material again for its original purpose, without the need for processing or manufacturing. Source reduction and reuse are optimal because they eliminate the need to landfill and incinerate materials and avoid the energy and expense required to sort, transport, process, and manufacture the materials into new products. According to EPA's WARM model, source reduction is preferable, in terms of greenhouse gas emissions, to all other options (recycling, land-filling, or combustion) for most materials.[49] The same is true with respect to energy use.[50]

Currently, Maryland uses a source reduction checklist, completed by the counties annually, to recognize and measure participation in source reduction initiatives. The Department maintains information on its "Buy Recycled" website to promote purchasing of recycled products.[51] In addition, it promotes a Buy Recycled training program and manual developed by Maryland Environmental Service and provides information and resources to local governments for recycling presentations to students.

[49] The exceptions are aluminum cans, medium density fiberboard, dimensional lumber, and carpet, which are better to recycle, according to WARM. EPA explains that "[t]his is because recycling is assumed to displace 100 percent virgin inputs, whereas source reduction is assumed to displace some recycled and some virgin inputs." See EPA, Why Recycling Some Materials Reduces GHG Emissions More than Source Reduction, http://epa.gov/epawaste/conserve/tools/warm/SRvsRecycling.html

[50] Aluminum cans and dimensional lumber are the two exceptions. EPA WARM Model, http://epa.gov/epawaste/conserve/tools/warm/index.html#excel

[51] MDE, "Buy Recycled," http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/SpecialProjects/Pages/Programs/LandPrograms/Recycling/specialprojects/ll.aspx

While source reduction is currently measured for MRA purposes using the activities listed on the source reduction checklist, the Department should ensure these activities are translating into real reductions in waste generation. Actual source reduction is difficult to quantify from year-to-year because waste generation tends to fluctuate with economic cycles and other conditions that vary over short periods of time. For example, yard waste and other debris may increase in a year with an extreme weather event, while construction and demolition debris may increase the following year as damaged property is demolished and rebuilt. However, over longer periods, adoption of zero waste principles should lead to reductions in waste through the following mechanisms:[52]

- Reduced material use in manufacturing, filling, packaging, and distribution;
- Increased product durability and reparability;
- Increased opportunities for reuse and donation; and
- More efficient consumer behavior (e.g. purchasing less food, better understanding of expiration dates, managing more organic materials through on-site composting, etc.)

Some of these changes are well-aligned with economic goals and are already apparent in global trends, such as progressive "lightweighting" of packaging over time. Others, such as increased product durability, may run counter to existing economic incentives and possible interventions should be considered.

To complement the existing source reduction credit system, the Department will track per capita waste generation to ensure there is an overall downward trend in generation over time. Maryland should strive to reduce waste generation to five pounds per person, per day by 2040, from approximately 6.1 pounds per person, per day in 2012. This would result in a reduction of more than 33 million tons of waste from 2013 through 2040, and disposal of 9.6 million fewer tons over that period, assuming the zero waste goals are met.

Initiatives

2015 – 2020

1.1 Study and update source reduction credits by 2016. Maryland's source reduction checklist was established in 2000. The checklist will be re-examined to identify additional source reduction strategies and to make any other improvements that may further encourage source reduction. In particular, the checklist system may need to be revisited to place more emphasis on strategies that have a demonstrated, measurable impact on waste generation. While some items on the checklist have been studied and proven to produce actual decreases in generation, other items are intuitively important but more difficult to validate (particularly some of the promotional and educational items). The checklist is structured so that credits correspond to the overall number of "yes" answers rather than to individual actions, which further complicates any efforts to validate the system.

[52] EPA, Decision Makers' Guide to Solid Waste Management, Ch. 5: Source Reduction (1995), http://www.epa.gov/osw/nonhaz/municipal/dmg2/

1.2 Conduct a source reduction outreach campaign directed at consumers. Achieving source reduction in the residential sector requires individuals to re-examine their purchasing behavior. While source reduction is the optimal strategy environmentally, recycling has historically received more emphasis in outreach efforts and individuals are likely to be less familiar with the concept of source reduction. A source reduction campaign would educate individuals on the benefits of source reduction and ways they can minimize waste. To the extent possible, the outreach campaign should build on existing initiatives, such as EPA's "Food: Too Good to Waste" Pilot and the U.K.'s "Love Food, Hate Waste" campaign, both directed at avoiding consumer food waste.

1.3 Provide source reduction technical assistance to businesses. MDE should provide or fund technical assistance to help businesses identify the causes and types of waste in their organizations and develop plans for source reduction. This assistance could include waste audits and staff training. The Department should also update and expand its source reduction website to include business case studies and guidance documents for achieving source reduction in business and institutional settings. In addition, this information should be distributed through the Maryland Green Registry as another way to encourage businesses to reduce waste.

1.4 Ensure that Extended Producer Responsibility systems are designed to encourage source reduction. Discussed in detail under Objective 2, EPR programs shift the financial and/or physical responsibility for managing products at end-of-life to the producers of those products and away from local governments. EPR programs can encourage source reduction if they require producers to contribute to end-of-life management based on the quantity of waste their products generate. Many of the European systems for packaging EPR impose stewardship fees on each producer based on the tons and type of material the producer uses in its packaging. The intent is that producers will seek to reduce the weight of packaging used and switch to packaging types that have a lower environmental impact. Direct take back programs (in which each producer takes actual, physical responsibility for managing its discarded products) may also create incentives for source reduction and product redesign.

1.5 Increase water conservation (source reduction). In addition to reuse of treated municipal wastewater, wastewater can be "source reduced" by managing demand within businesses and residences. This is accomplished by reducing water consumption and reusing water on-site. The Department has published extensive outreach materials and best management practices on reducing water usage.[53] The Department will:

- Conduct an integrated water education program, including water conservation and reuse in the business and residential sectors. This should be accomplished through partnerships with the Joint Water Reuse Committee of the Chesapeake Section of the American Water Works Association and Chesapeake Water Environment Association, local governments, educational institutions, engineering firms, and

[53] MDE, Water Conservation, http://mde.maryland.gov/programs/Water/WaterConservation/Pages/Programs/WaterPrograms/water_conservation/index.aspx

developers. It should also leverage existing outreach campaigns, including EPA's WaterSense outreach campaign;

- Work with local governments to evaluate possibilities for reuse of water within homes and commercial buildings, including grey-water and roof runoff;
- Expand financial incentives for installation of low-flow fixtures and appliances and other water-conserving measures;
- Provide or fund individual technical assistance for large consumers of water;
- Evaluate rate structures or surcharges that would encourage customers to reduce water usage; and
- Promote case studies of existing decentralized water reuse systems, including those at State government-occupied facilities. For example, MDE's headquarters in Baltimore is located at a building that reuses stormwater for toilet flushing and cooling.

1.6 Increase water reuse. Maryland's use of reclaimed water is increasing, but remains low relative to leading states. The Department, in consultation with stakeholders, will evaluate options to encourage additional use of reclaimed water, including:

- Requiring proposed projects or facilities that would use more than a certain threshold quantity of water to use or consider use of reclaimed water;[54]
- Establishing financial incentives for use of reclaimed water;
- Conducting outreach and training to potential users of reclaimed water; and
- Reviewing existing guidelines and treatment requirements for water reuse periodically to identify any unnecessary barriers.

2021 - 2025

1.7 Organize waste exchanges. A waste exchange is a market where individuals and businesses can offer and obtain materials for reuse, preventing them from becoming wastes. This can be a physical location, such as a paint reuse program hosted at a local household hazardous waste drop-off, or a website. There are many examples of waste exchanges that serve various geographic areas in the U.S.,[55] but there are currently no exchanges serving Maryland.[56] MDE, in consultation with stakeholders, will work to establish regional waste exchanges in Maryland.

2026 -2030

1.8 Research methods of encouraging sustainable product design. The zero waste principles advocate a shift of focus upstream to issues of product design and manufacturing. Maryland should encourage sustainable design and manufacturing techniques that reduce the amount of waste generated over all phases of a product's lifecycle. This strategy, while a defining principal of zero waste, can be challenging to

[54] California law requires use of recycled water for certain nonpotable uses (cemeteries, golf courses, parks, highway landscaped areas, and industrial and irrigation uses) where there is an available source of recycled water of adequate quality. Ca. Water Code § 13550 et seq.

[55] Southern Waste Information Exchange, Materials Exchange Information, "List All Materials Exchanges," http://mxinfo.org/list.cfm

[56] The website MDRecycles.org contains a directory of recyclers of various materials serving Maryland, but the site does not focus on reuse and does is not an exchange, in that it does not allow users to receive materials.

promote through government policies because of the complexity of decision making at the design and manufacturing stages. This is particularly true where producers are multinational companies and Maryland policies affect only a small portion of their overall operations.

Maryland will conduct research and evaluate options for encouraging sustainable product and process design, with an initial focus on businesses with manufacturing operations in the State. Experience in other states and other countries will be leveraged to develop a set of recommended policies. Examples of approaches being explored in other jurisdictions are as follows:

- Product labeling, certification and other forms of recognition can signal to consumers that a product has been designed and manufactured for source reduction or enhanced recyclability. The Department will examine voluntary efforts of producers to create zero waste manufacturing processes; for example, Nestlé has committed to making all of its European factories "zero waste factories" by 2020.[57]
- Oregon's plan, *Materials Management in Oregon: 2050 Vision and Framework for Action*,[58] identifies several possibilities for influencing upstream design and production. These include subsidies and other incentives for sustainable product design, standardization of measurement of product impacts and environmental rating systems, and business outreach on the benefits of green chemistry.[59]

Objective 2 – Increase Recycling Access and Participation

Background

This objective seeks to increase waste diversion by making recycling as widely available as disposal across all sectors and all areas of the State. To complement increased access, this section also identifies actions that will incentivize, and eventually require, participation in recycling opportunities.

Businesses and institutions are target sectors and present unique challenges. In Maryland, most non-residential generators must privately contract for collection of waste and recyclables. Recycling reporting is voluntary on the part of businesses, and the State and local governments lack adequate information about recycling that is currently occurring in these sectors. In addition, businesses have waste streams that tend to vary from the residential sector and across business types. For example, a restaurant may generate mostly organics while an office would generate mostly paper.

Product Stewardship and Extended Producer Responsibility initiatives could significantly advance Maryland's objective to increase recycling. Product Stewardship is:

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[57] Environmental Leader, "Nestlé Makes Zero Waste Pledge for All Europe Factories," (Oct. 18, 2013), http://www.environmentalleader.com/2013/10/18/nestle-makes-zero-waste-pledge-for-all-europe-factories/

[58] Oregon Department of Environmental Quality, *Materials Management in Oregon: 2050 Vision and Framework for Action* (2012), http://www.deq.state.or.us/lq/pubs/docs/sw/2050vision/MaterialsManagementinOregon.pdf

[59] EPA defines green chemistry as "the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances." EPA, Green Chemistry, http://www2.epa.gov/green-chemistry

"[T]he act of minimizing health, safety, environmental and social impacts, and maximizing economic benefits of a product and its packaging throughout all lifecycle stages. The producer of the product has the greatest ability to minimize adverse impacts, but other stakeholders, such as suppliers, retailers, and consumers, also play a role."[60]

While Product Stewardship initiatives can be voluntary or mandatory, "Extended Producer Responsibility (EPR) is a mandatory type of product stewardship that includes, at a minimum, the requirement that the producer's responsibility for its product extends to post-consumer management of that product and its packaging. There are two related features of EPR policy: (1) shifting financial and management responsibility, with government oversight, upstream to the producer and away from the public sector; and (2) providing incentives to producers to incorporate environmental considerations into the design of their products and packaging."[61]

These concepts are aligned with the principles of zero waste discussed in Chapter 2. Their effectiveness derives from the application of incentives "upstream" to the parties in the best position to improve recyclability and reduce the generation of waste through better product design and marketing practices. EPR as a strategy for addressing packaging waste overall is discussed under this objective. For additional strategies involving EPR for particular materials, see Objective 4.

Initiatives

Underway

2.1 Increase mandatory county recycling rates. Recent legislation, Chapter 692, Acts of 2012, increased the mandatory county recycling rates to 20% and 35%, depending on population. Revised county recycling plans to achieve the new rates were submitted to MDE by July 2014, with full implementation by December 2015.

2.2 Implement multi-family recycling. Section 9-1711 of the Environment Article requires apartment and condominium buildings with 10 or more units to provide recycling opportunities to their residents, effective October 1, 2014. Under §9-1703, counties were required to address multi-family recycling in their county plans by October 1, 2013.

2015 - 2020

2.3 Quantify the level of business recycling. Accurate information about business recycling is important, not only to measure progress toward the zero waste goals, but to determine where additional outreach efforts are needed.

In 2010, MDE convened a study group to consider various solid waste and recycling issues in Maryland. The Study Group determined that the lack of business reporting is a

[60] Product Stewardship Institute, http://www.productstewardship.us/
[61] Id.

significant impediment to quantifying waste diversion in the business sector.[62] Attempts by MDE and the counties to obtain complete business recycling information voluntarily have been unsuccessful. MDE and stakeholders discussed several options for obtaining the data on a mandatory basis, including reporting by haulers or by businesses. Reporting by businesses has the advantage of providing county-by-county data, which can be used by the counties in meeting the mandatory county recycling rates. Montgomery County currently requires reporting by businesses with over 100 employees. The State should consider a similar reporting mandate, with the data submitted to the counties for use in their annual MRA reports.

2.4 Implement away-from-home and event recycling. In 2014, the General Assembly passed Chapter 338, which requires organizers of certain special events held on public property to provide for recycling. The counties must also update their recycling plans to address special event recycling. In addition to providing information for special event organizers subject to the new mandate, counties and the Department should identify methods to encourage away-from-home recycling in situations not covered by the 2014 legislation. Possible initiatives include:

- Providing grants for recycling bins in public spaces to municipalities or counties, or promoting similar programs hosted by private organizations.
- Phasing in, beginning in 2017, a mandate on provision of recycling bins wherever trash cans are located in places open to the public. Vermont has begun a similar initiative with the passage of a 2012 law which will require recycling containers at all State and municipally owned places where trash cans are located.[63]
- Posting resources and information on MDE's website for hosting zero waste events.

2.5 Phase in disposal bans on recyclables. Several U.S. states, such as Massachusetts and Wisconsin, have prohibited disposal of certain recyclables for which adequate recycling opportunities are available. This includes recyclable paper and cardboard, glass and metal containers, and plastic bottles. Disposal bans may apply to generators of the materials, haulers, and solid waste facilities. MDE will evaluate access to recycling services for these materials and develop a series of recommended progressive disposal bans in 2018. Similar to the organics disposal ban discussed under Objective 3 below, these disposal bans could begin with the largest generators of the materials. (For disposal bans as a method of addressing specific target materials, see Objective 4 below.)

2.6 Encourage pay-as-you-throw (PAYT). PAYT systems can drastically reduce residential waste disposal by providing individual incentives to change recycling and disposal behavior. In most existing systems, trash pickup is funded by flat fees or taxes. In these systems, the individual has no financial interest in reducing disposal. In a PAYT system, an individual pays a variable rate for trash pickup that is based on the amount of trash the individual sets out for disposal. Recycling is typically "free" to the individual, though its cost is actually internalized into the price for trash pickup. This approach is similar to

[62] MDE, Solid Waste Management – Recycling and Source Reduction Study Group Final Report, p. 20 (2013), http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/Publications/Documents/SW%20Task%20Force%20Final%20Report%20FINAL%207%2031%2013.pdf

[63] Vermont Act 148 of 2012.

variable pricing for metered utilities, such as electricity and gas. A study sponsored by EPA examined disposal behavior in over 1,000 PAYT communities. It found that PAYT programs reduced residential MSW by an average of 17% due to source reduction, increased recycling, and use of yard waste pickup.[64] However, well-designed programs can yield much greater reductions, over 40% in some cases. In Gloucester, Massachusetts, for example, the City was able to further reduce disposal by an additional 26% by switching from an existing sticker-based PAYT system to a more efficient bag-based PAYT system.[65]

Some communities may be hesitant to adopt PAYT due to perceived challenges in implementation. While there may be initial costs to transition to unit-based pricing, research has shown that administrative burdens do not increase for the majority of communities that adopt PAYT.[66] Another concern is that illegal dumping will increase as consumers seek to avoid paying for collection under a PAYT system. Research has shown that though this problem is reported as a significant concern, it is actually fairly rare (less than 20% of PAYT communities) and temporary (less than 3 months).[67] Problems with illegal dumping can be lessened by providing periodic disposal of bulky materials, which make up the majority of illegally discarded items. Enhancing education and enforcement of litter laws also helps to address this temporary issue. Restructuring the payment system through PAYT can provide additional funds to more effectively tackle litter problems.

In Maryland, pricing systems vary by county and municipality. A few Maryland communities have instituted PAYT pricing, including the City of Aberdeen and Charles County,[68] but the practice is not widespread. MDE will, beginning in 2016, encourage local governments to institute PAYT programs by:

- Providing sample ordinances, policies, or regulations;
- Maintaining information about PAYT on its website, including case studies, research, and manuals;
- Educating local governments about the results of PAYT programs in terms of recycling rate increases, source reduction, and costs;
- Providing local governments with technical assistance in designing PAYT; and
- Considering legislative options for increasing PAYT. Options include a State-wide PAYT requirement similar to the one enacted in Vermont[69] or a waste reduction standard that would allow local governments to meet per capita residential disposal caps through PAYT or alternative efforts (see Initiative 2.8).

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[64] Skumatz, Lisa A., Ph.D. and David J. Freeman, "Pay as you Throw (PAYT) in the US: 2006 Update and Analyses", prepared for US EPA by Skumatz Economic Research Associates, Superior CO, December 2006, http://www.epa.gov/osw/conserve/tools/payt/pdf/sera06.pdf

[65] Waste Zero, Gloucester, MA Case Study, http://wastezero.com/media/17559/Gloucester_WZ%20Case%20Study.pdf

[66] Skumatz, supra note 66.

[67] Id.

[68] In Charles County, residents have the option to contract with private haulers for curbside trash pickup or to use county drop-off sites. Variable rate pricing is implemented at the county drop-off sites. Each prepaid ticket, which costs $1.75, authorizes disposal of one 32-gallon bag of trash. *See* Charles County, Trash Disposal and Tag-a-Bag Program, http://www.charlescountymd.gov/pw/environmental/trash-disposal-and-tag-bag-program

[69] 24 V.S.A. § 2202a(d).

2.7 Support extended producer responsibility for packaging. An EPR system for Maryland should improve availability and convenience of recycling services while making efficient use of existing recycling infrastructure. Maryland's local governments have had the primary responsibility for implementing recycling programs for more than 20 years since adoption of the Maryland Recycling Act. During this time, they have made significant investments to improve their programs and have gained extensive experience responding to local conditions. However, funding for continued improvements is limited. The Department believes that an optimal EPR system for packaging would preserve local government involvement in recycling programs while holding producers financially responsible for environmental impacts of their packaging choices.

In addition to many European countries, packaging EPR currently exists in five Canadian provinces.[70] Since the Canadian programs tend to be newer than European programs, the Department is tracking Canadian EPR programs as examples of how an EPR program might be implemented in a jurisdiction with significant existing local infrastructure. The Canadian programs also demonstrate varying approaches to municipal involvement and apportioning of responsibility; tracking their performance and any problems that arise will be useful in assessing EPR proposals for Maryland. Packaging EPR bills introduced in 2013 in North Carolina and Rhode Island and future U.S. bills are also being tracked.[71]

In any EPR system, efforts should be made to align the program with similar programs existing or under development in other states. The Department will continue to examine the variations among existing and proposed programs to determine the best type of EPR system for Maryland by 2018.

2.8 Consider further increases in minimum county recycling rates and establish maximum disposal rates. As discussed above, counties will have fully implemented new recycling plans by December 2015 to achieve at least 20% or 35% recycling, depending on population. As the near-term strategies in this Plan are completed, the mandatory county rates should be reexamined to ensure they preserve incentives for continual improvement of local recycling programs.

In addition to and corresponding with the State's mandated minimum recycling rates, the State should consider establishing maximum waste disposal per capita for local jurisdictions. A 2014 bill introduced in Massachusetts would require the State to set a performance standard of no more than 450 pounds of MSW disposed per resident served by a local government program.[72] In reporting progress toward the standard, local governments would be authorized to disaggregate certain categories of waste that may be beyond the local government's control, such as waste from natural disasters.

[70] As of the publishing of this Plan, the five provinces were Ontario, British Columbia, Manitoba, Quebec, and Saskatchewan (program will be implemented January, 2015). Packaging EPR has been informally proposed for public consultation in Alberta.
[71] North Carolina 2013 House Bill 949; Rhode Island 2013 House Bill 5264.
[72] Massachusetts H. 4317 (2014).

Reevaluation of minimum recycling and maximum disposal rates should be repeated every 5 years, beginning in 2020.

2.9 Boost reuse and recycling of construction and demolition debris. In 2012, 1.7 million tons of C & D materials were disposed in Maryland. This demonstrates the importance of expanding State's focus beyond MRA materials in order to achieve zero waste. Local jurisdictions across the U.S. have developed a variety of policies aimed at encouraging diversion of C & D materials. These policies are often incorporated into the local building permit process. Examples include: minimum recycling and reuse rates; disposal bans on certain types of C & D materials; requiring new construction to include a certain percentage of salvaged materials; voluntary or mandatory take-back programs for producers of carpet and other selected C & D wastes; deposits paid by contractors that are refunded upon proof of recycling; planning and reporting requirements; and subsidized recycling services.[73]

The State should assist builders and local governments in diverting more C & D materials by:

- Working with counties and municipalities to promote the local policies listed above, particularly minimum diversion requirements and minimum salvaged material requirements for new construction;
- Considering action on select policies better enacted at the State level, such as EPR programs for carpet and disposal bans on some types of C & D materials;
- Creating an ongoing partnership with the Building Materials Reuse Association, Construction and Demolition Recycling Association, Green Building Council, and other related organizations to provide outreach, education, technical assistance, and research on C & D reuse and recycling. In particular, this partnership could be leveraged to create regional C & D materials exchanges, conduct pilot and recognition programs, and support training programs in the field of building de-construction.

2026 - 2030

2.10 Adopt universal recycling. Universal recycling laws ensure that recycling is available and required for all residences and businesses. Several states and local jurisdictions have already adopted universal recycling or mandatory commercial recycling laws. These laws vary somewhat in their content, but Maryland should consider a system of universal recycling similar to those in Delaware, Vermont, and Prince George's County in Maryland.[74] A universal recycling law might include the following requirements:

[73] CalRecycle, California Jurisdictions with C&D Diversion Programs, http://www.calrecycle.ca.gov/ConDemo/Ordinances/ ; Cook County, IL Ordinance **12-O-37;** NERC, Summary of U.S. State and Municipal C & D Regulations and Requirements, http://nerc.org/documents/summary_of_state_candd_reg_requirements.pdf; CalRecycle, C&D Recycling Plans and Policies:A Model for Local Government Recycling and Waste Reduction, http://www.calrecycle.ca.gov/LGCentral/Library/innovations/CnDRecycle/

[74] 10 V.S.A. § 6602 et seq.; 7 Del. Code. § 6053; Prince George's County Code 21-142(g).

- Any entity that collects and hauls trash must also provide separate collection of recyclables, or sub-contract with a recycling hauler to provide collection of recyclables.
- Any local government that provides trash pickup to residents or businesses must also provide recycling and organics pickup to those residents and businesses.
- Haulers and local governments that collect recyclables and organic waste must deliver those materials only for recycling, composting or anaerobic digestion and not for disposal.
- Residents and businesses receiving trash services may not opt out of recycling service.
- Disposal bans, discussed above, would be concurrently phased in to ensure that recycling services are used.

Objective 3 – Increase Diversion of Organics

Background

Maryland already diverts significant quantities of yard trimmings, recycling an estimated 70.9% of all yard trimmings generated in the State. Section 9-1724 of the Environment Article of the Maryland Code prohibits disposal of separately collected loads of yard waste at refuse disposal facilities in Maryland. Interest in composting of food scraps has dramatically increased in recent years, with siting of several new food composting facilities and pilot projects in the State. However, food composting infrastructure is still not adequate to serve the entire State and the food composting rate remains low, at an estimated 8.5% in 2012.

Organics are a priority material, not only because they compose a large portion of the waste stream (see Chapter 1), but because disposal of organics has a significant impact on greenhouse gas emissions. Organic materials break down in landfills in the absence of oxygen, generating methane, a greenhouse gas that is up to 34 times more potent than carbon dioxide.[75] Even modern, well-designed landfills with landfill gas collection systems do not prevent escape of all methane. Some recent research notes that the capture rate is difficult to measure and suggests that it may be lower than some previous estimates.[76] EPA estimates that landfills are the source of 17% of U.S. methane emissions, so diverting organics away from landfills can have a

[75] Myhre, G. et al. (2013) Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, Table 8-7, http://www.climatechange2013.org/images/report/WG1AR5_Chapter08_FINAL.pdf (Using a 100-year time horizon and including carbon-climate feedbacks).

[76] ARCADIS, U.S., Inc., Quantifying Methane Abatement Efficiency at Three Municipal Solid Waste Landfills (2012) (prepared for EPA National Risk Management Research Library), http://nepis.epa.gov/Adobe/PDF/P100DGTB.pdf
(Stating that "[o]f the area source emissions, landfills are considered the most challenging [to quantify emissions] because of their size, and ever changing nature due to changes in waste composition, design and operation" and that the data "does not support the use of collection efficiency values of 90% or greater as has been published in other studies.")

substantial impact on reducing greenhouse gas emissions.[77] Compost improves soil quality by improving pH and soil structure, adding nutrients that are slowly released over time, increasing water retention, and helping to control erosion.

Chapter 363, Acts of 2011 required MDE, in consultation with other State agencies, to study composting in the State and develop a set of recommendations to increase composting. The Department hosted a Composting Workgroup comprised of composters, local governments, the Maryland Environmental Service (MES), the Maryland Department of Agriculture (MDA), public interest organizations, and other experts on composting. The Workgroup report with recommendations was published in January 2013.[78] One focus of the recommendations was the need to create a clearer regulatory pathway for new composting facilities, particularly for food scrap composting. Chapter 686, Acts of 2013 required MDE to adopt new regulations for composting facilities, including a composting-specific permit and design and operational requirements. These developments will make it easier for new composting facilities to begin operating by establishing clear regulatory requirements. Siting new facilities is essential to managing the volume of food scraps available for composting and increasing diversion of organics. At the time of the Composting Workgroup Report, there were 13 known composting facilities operating in Maryland, with only four accepting food (and two of these operating at pilot-scale).

Initiatives

Underway

3.1 Finalize and implement new composting regulations. After the Composting Workgroup completed its work in December 2012, MDE re-started meetings with a smaller subgroup to discuss and draft the new regulations required by Chapter 686, Acts of 2013. These regulations are projected to be finalized in early 2015 and are expected to result in an increase in the number of composting facilities in the State.

2015-2020

3.2 Publish composting facility guidance. During the Composting Workgroup process, stakeholders requested that along with new regulations, MDE provide a guidance document to convey in clear, plain language, all information that a potential composter would need to know in order to operate lawfully in Maryland. The Department will publish this guidance concurrent with the final regulations.

3.3 Encourage food donation. Optimally, edible leftover food should be used to feed people (See Figure 10: Food Management Hierarchy). According to Feeding America, over

[77] EPA, Overview of Greenhouse Gases: Methane, http://www.epa.gov/climatechange/ghgemissions/gases/ch4.html
[78] MDE, Composting Workgroup Final Report (2013), http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/Publications/Documents/composting_workgroup_final_report_1-2013000%20(1).pdf

770,000 Marylanders were food insecure in 2012, including almost 260,000 children.[79] In order to ensure that edible surplus food is put to its best use, MDE will:

- Identify and survey large food scrap generators to determine the quantities and locations of available food and to gauge the current level of participation in food donation.
- Provide information and resources on MDE's website regarding food donation.
- Promote a hierarchy of food management that prioritizes, after source reduction, feeding people in need.
- Facilitate contact between Maryland food waste generators and Feeding America, food banks, soup kitchens, food pantries, shelters, and other organizations in need of food donations. This may include hosting a food recovery workshop.

3.4 Launch an education and outreach campaign targeted to organics. As infrastructure for recycling organics develops in Maryland, many businesses and individuals will, for the first time, have access to services for recycling the organics they generate. However, diversion of these organics will require a change in behavior on the part of generators. An outreach campaign will be employed to convey the benefits of composting and practical information about how to participate. The campaign will be targeted to three key sectors that play significant roles in composting: residents, local governments, and large generators of organics (such as universities, hospitals, and food-related businesses). Specific Composting Workgroup recommendations related to outreach will be the basis for developing the campaign, and additional input will be sought from stakeholders. As suggested in the Workgroup recommendations, the outreach program should be a coordinated effort among MDE, MDA, University of Maryland Extension, Maryland Agricultural Education Foundation, and other environmental education organizations.

3.5 Promote compost use in a wide variety of applications. Chapter 430, Acts of 2014 established that the use of compost and compost-based products in highway projects is a best management practice for erosion and sediment control and post-construction stormwater management. The law also directs the State Highway Administration to establish compost specifications for these uses by the end of 2014. MDE should promote these and other uses for compost, including in agriculture, landscaping, and soil remediation by:

- Reviewing MDE's Soil Erosion and Sediment Control Manual and Stormwater Design Manual to ensure compost use is encouraged wherever appropriate;
- Providing information on compost uses on MDE's composting website; and
- Working with the Maryland-DC Compost Council and other stakeholder groups to provide education and outreach on compost uses.

3.6 Phase in a disposal ban on commercial and institutional organics. The capacity for processing organics in Maryland is expected to increase as the new regulations are fully implemented. Concurrent with this expansion, the State must ensure that an increasing supply of diverted materials is available to the new facilities. Beginning with the largest generators of organics, the disposal ban would require that commercial and institutional

[79] Maryland Food Bank, Map the Meal Gap, http://feedingamerica.org/hunger-in-america/hunger-studies/map-the-meal-gap.aspx

entities use source reduction, food donation, composting, or anaerobic digestion to manage organics. The threshold quantity of organics generation that would subject an entity to the disposal ban should start at one ton of organic waste generated per week and decrease over time, as services become increasingly available. The Department should support organics disposal ban legislation for passage by 2016, with the first phase of bans effective by 2017.

3.7 Encourage anaerobic digestion. Use of anaerobic digestion (AD) for organics such as food scraps and animal manure is growing in popularity in the U.S. and is proven over decades of use in Europe. AD technology is now commercially available in the U.S. and presents an additional opportunity for diversion of organics, either alone or coupled with composting of digestate. AD also generates renewable energy that displaces carbon-intensive sources of energy, thus reducing greenhouse gas emissions. After the composting regulations are implemented, beginning in 2015, the Department will evaluate whether additional regulatory authority or new regulations are necessary to address AD. The Department will also meet with other relevant agencies, including MES and the Maryland Energy Administration, to identify ways in which AD can be encouraged in the State. The State's review of AD should be completed by 2016.

3.8 Decrease plastic bag usage for organics collection. Plastic bags used to contain source-separated organics for collection create operational and product quality issues for composting facilities. Bagged material must be emptied prior to composting, either by labor-intensive manual debagging or mechanical shredding in which bags can become caught in machinery. During the composting, film plastic can be blown off site or into fences and must be collected for proper disposal. Finally, while operators attempt to screen most plastic from finished compost, too much plastic in the product can make it unattractive to buyers. MDE will consider how best to address this issue and may recommend legislation. Additionally, MDE, in consultation with local jurisdictions and composting facility operators, will work to identify and evaluate potential alternatives to non-compostable plastic bags, including compostable plastics, paper bags, and reusable bins.

3.9 Decrease disposal of sewage sludge. Of the Maryland-generated sewage sludge managed in State, approximately 12% was disposed in 2012, while the rest was stored, applied to agricultural or marginal land, or marketed for sale. While this represents a high level of diversion relative to many other materials, there is still opportunity to divert the remaining sludge through AD or composting. In addition, existing digesters located at wastewater treatment plants may be leveraged to co-digest food with sewage sludge.

2026 - 2030

3.10 Institute universal organics diversion. The ultimate goal of the State's organics strategy is to ensure that individuals, businesses, and institutions have universal access to recycling services for organics. This could be accomplished by requiring private haulers or local governments to offer separate collection of organics for composting wherever waste is collected. Universal collection would be coupled with an eventual blanket prohibition on disposal of organics.

Objective 4 – Address Specific Target Materials

Background

Some materials warrant special consideration because of their particular environmental impacts or the practical challenges inherent in end-of-life management. Examples are:

- Materials that are bulky and take up disproportionate landfill space relative to their share of the waste stream (e.g., mattresses, carpet).
- Materials that are economically or technologically infeasible to recycle, or that are not typically accepted through the main recycling channels (e.g., polystyrene foam).
- Materials that are frequently littered (e.g., beverage containers, carryout bags).
- Materials that present specific environmental or public health risks if improperly managed (e.g., pharmaceuticals, mercury-containing products).

In Maryland, the burden of dealing with difficult materials has historically fallen on counties and municipalities that manage solid waste and recycling programs. Local governments have been successful in implementing recycling programs for some difficult materials. Electronics recycling programs, discussed below, are a case in point. However, because local governments are limited in resources and geographic influence, they have limited ability to produce the kinds of upstream changes that would reduce end-of-life management problems. Many of the actions listed below attempt to re-distribute this burden more evenly among producers, consumers, and government.

Initiatives

2015 - 2020

4.1 Conduct a waste sort. As discussed in Chapter 1 of this Plan, Maryland receives reports of material-specific recycling volumes, but does not receive a similar breakdown for waste disposal. As a result, the Department must extrapolate from EPA waste generation information for the entire U.S. to draw conclusions about specific materials in Maryland. The disadvantage to this method is that it assumes Maryland's waste stream is identical to the waste stream in the U.S. as a whole. To obtain more accurate empirical information about which materials need to be targeted for increased recycling in Maryland, the Department should conduct a State-specific waste sort by 2016. The Department's sort should also include a review of the several waste sorts done by Maryland counties over the past decade.

4.2 Adopt a disposal ban on electronics. Disposal bans prohibit landfills and incinerators from accepting certain items for disposal and may also prohibit generators from discarding these materials in the trash. Electronic devices contain toxic materials, such as lead, mercury, cadmium, and arsenic, which should be eliminated from the waste stream wherever possible. Maryland law encourages electronics manufacturers to institute take-

back programs for end-of-life devices by providing a reduced renewal fee for the registration requirement imposed on all manufacturers.[80] In 2001 - 2002, Maryland participated in a pilot program with the rest of EPA Region 3 in which local government electronics recycling programs and events were funded and advertised.[81] Over the last decade, local governments have largely stepped in to provide their residents with permanent electronics collection sites or collection events.[82] Despite the availability of these opportunities for electronics recycling, there is currently no prohibition on disposal of electronic devices in the trash. Therefore, a ban on the disposal of electronics should be enacted in Maryland by 2016.

4.3 Establish EPR programs for mattresses and other difficult-to-manage materials. An estimated 20 million mattresses are discarded in the U.S. each year, and it is likely that less than 2% of these are recycled.[83] Mattresses present challenges for disposal because they are bulky and not easily compacted, making transport and disposal inefficient. In addition, while mattresses are recyclable, the prevailing method of separating steel, foam, wood, and cotton involves a labor intensive manual process. These issues, as well as a widespread perception that handling used mattresses is an unsanitary practice, has resulted in a dearth of voluntary recycling programs among mattress retailers, producers, and even local governments. In 2013, California, Connecticut, and Rhode Island passed the first mattress EPR programs, which mandate manufacturer-developed recycling plans along with a per-unit fee on the retail sale of each mattress.[84] These bills were supported by the International Sleep Products Association. A similar program in Maryland could help to increase and fund the diversion of mattresses and should be pursued by 2017.

Other states and localities have also used EPR to address materials such as paint and carpet.[85] Maryland will examine these and other programs to determine whether EPR is an appropriate solution for these materials. The Department should complete its examination by 2018. In addition, the Department should request assistance from local governments on

[80] Environment Article, §9-1728(c), Annotated Code of Maryland.
[81] EPA Mid-Atlantic Region, Final Report on the Mid-Atlantic States' Electronics Recycling Pilot (2004) http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/SpecialProjects/Documents/www.epa.gov/reg3wcmd/eCycling/pdf/FinaleCyclingReportApril2004.pdf
[82] See MDE's website, "E-cycling in Maryland," for a list of permanent collection programs offered by local governments and electronics manufacturers. http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/SpecialProjects/Pages/Programs/LandPrograms/Recycling/specialprojects/ecycling.aspx
[83] International Sleep Products Association estimates 20 million mattresses are discarded annually. Presentation by Chris Hudgins, ISPA, at Resource Recycling 2013 Conference, http://www.resource-recycling.com/RRC13proceedings/Hudgins.pdf . EPA estimated that 10,000 tons of mattresses were recycled in 2011. Assuming 70 pounds per mattress on average, this would be less than 300,000 mattresses, or 1.5% of all mattresses discarded. EPA, Municipal Solid Waste in the United States, Facts and Figures for 2011, http://www.epa.gov/epawaste/nonhaz/municipal/pubs/MSWcharacterization_fnl_060713_2_rpt.pdf
[84] Rhode Island H 5799 (2013); California SB 254 (2013); Connecticut, Public Act 13-42 (2013)
[85] Minnesota, Vermont, Rhode Island, Connecticut, California, and Oregon have similar laws requiring paint producers to develop and implement paint recycling plans that include take-back locations. These programs are funded through fees on the sale of paint. See PaintCare, http://www.paintcare.org/index.php. California has established EPR for carpeting.

a regular basis in identifying problem materials and considering possible solutions that may involve EPR.

4.4 Adopt a carryout bag reduction and recycling law. Plastic carryout bags have a disproportionately high environmental impact relative to their small fraction of the waste stream. (All plastic bags, sacks, and wraps generated in 2011 constituted only 1.5% of the total U.S waste stream.[86]) They are a significant component of litter and are easily blown into storm drains and waterways. The Anacostia River and parts of the Patapsco River are listed as impaired for trash under the Clean Water Act. A trash Total Maximum Daily Load (TMDL) was established in 2010 for the Anacostia River. Plastic bags can also be difficult to manage; if they end up in the wrong recycling channel they can become caught in equipment, increasing operational costs for recyclers. As a result, although recycling of plastic bags is technologically possible, many local programs in Maryland exclude plastic bags from residential recycling programs.

Legislation to address plastic bag waste comes in three forms: mandatory take-back programs, fees, and bans. Take-back programs require stores or manufacturers that provide plastic bags to collect used bags at the store and recycle them. Fees require customers to pay for each plastic bag they receive, so that a part of the environmental cost of the bags is internalized when customers elect to use them. Bans prohibit stores from providing customers with plastic bags for carrying purchases.

Recycling rates for plastic carryout bags remain low even in places with mandatory take-back programs.[87] Take-back programs alone do not provide incentives for consumers to return bags for recycling. The optimal solution is one that encourages less disposable bag use – either through a fee or ban. The fee has the benefit of providing a revenue stream that can be used for litter cleanup or recycling programs, while the ban would likely result in more source reduction. These approaches are both represented within Maryland at the local level – Montgomery County has a bag fee, while the town of Chestertown in Kent County has a bag ban. Some municipalities outside Maryland have combined the two strategies, instituting a ban on plastic carryout bags with a fee on paper carryout bags.[88] (While paper bags are recyclable or compostable, use of reusable bags is a form of source reduction, which is preferable to recycling and composting.) A study comparing customer behavior in Montgomery and Prince George's counties underscores the effectiveness of a bag fee. Shoppers in Montgomery County were more likely to use reusable bags than Prince George's County shoppers (57% compared to 8%), as well as to carry purchases without bags (18% compared to 4%).[89] The disparity in reusable bag use was apparent even after accounting for income differences.

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[86] EPA, Municipal Solid in the United States Facts and Figures 2011, http://www.epa.gov/epawaste/nonhaz/municipal/pubs/MSWcharacterization_fnl_060713_2_rpt.pdf

[87] See, e.g. CalRecycle, 2009 Statewide Recycling Rate for Plastic Bags, http://www.calrecycle.ca.gov/plastics/AtStore/AnnualRate/2009Rate.htm (Reporting a recycling rate of 3% in 2009).

[88] See, e.g., Los Angeles County Code, Chapter 12.85.010; Seattle Municipal Code § 21.36.100. Note that these and similar laws allow the retailer to keep the fee on paper bags, but specify that the proceeds must be used for costs related to implementing the law and providing paper bags.

[89] Sierra Club Maryland Chapter, Testimony on 2014 HB 718 Before House Environmental Matters Committee.

The Department will evaluate and recommend one or more options to address carryout bags by 2016.

4.5 Adopt a beverage container recycling law. Beverage containers constitute about 4.53% of the waste stream in the United States. [90] However, like plastic bags, they are frequently littered and often consumed away from home where they are less likely to reach recycling collection points. Because beverage containers are typically made from materials that are easily recycled through existing infrastructure, they represent an area of opportunity for capturing more of Maryland's waste stream. In 2012, Maryland's recycling rate for beverage containers was estimated at 42.8%.

Potential legislation designed to increase beverage container recycling could include deposits or recycling fees on beverage containers, mandatory recycling for bars and restaurants, or EPR-style programs in which producers must establish recycling programs. Programs that create a dedicated recovery system for beverage containers have the benefit of yielding higher quality material streams with less contamination and less breakage of glass.

Beverage container deposit legislation has been repeatedly introduced in the General Assembly in recent years. The Department should consider deposit systems that are financially sustainable even at high levels of container redemption. It is not unusual among existing deposit states for redemption rates to reach 80% or higher. Achieving a high redemption rate is the goal of the program, but also limits the quantity of unredeemed deposits left to pay for operation of the redemption system. This issue is addressed in some states by requiring beverage distributors to fully fund the costs of redemption.

The Department will continue to consider and evaluate alternative solutions for beverage container recycling and recommend legislation in 2017.

4.6 Study potential solutions for pharmaceuticals. End-of-life management of pharmaceuticals presents important environmental and public health concerns. Improper disposal of pharmaceuticals by flushing leftover drugs down the toilet has contributed to detectable levels of pharmaceuticals in drinking water and fish tissues. Safety concerns, including accidental exposure and illegal abuse, have historically resulted in recommendations that consumers flush unused medication. Proper disposal for some types of medication continues to be debated at the federal level.[91] Federal legislation passed in 2010 has sought to make it easier for controlled substances to be transferred from their owners to authorized entities for disposal through collection programs; Federal regulations

[90] EPA, Municipal Solid in the United States Facts and Figures 2011, http://www.epa.gov/epawaste/nonhaz/municipal/pubs/MSWcharacterization_fnl_060713_2_rpt.pdf

[91] See FDA, "How to Dispose of Unused Medicines," (2011) ("Despite the safety reasons for flushing drugs, some people are questioning the practice because of concerns about trace levels of drug residues found in surface water, such as rivers and lakes, and in some community drinking water supplies."), http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm101653.htm ; EPA, "Pharmaceuticals and Personal Care Products in Water," http://water.epa.gov/scitech/swguidance/ppcp/

to implement this law are currently proposed.[92] (Controlled substances include narcotic pain relievers and other drugs specified in federal regulations for more stringent control because of their potential for abuse and/or dependence.)

Within Maryland, limited permanent collection opportunities exist at some police stations and pharmacies, including through a mail-back program called "Dispose My Meds" and a State drug repository program that provides unused medication to those in need. Some Maryland locations also participate in the National Prescription Drug Takeback Day.[93] No states have yet passed mandatory pharmaceutical stewardship laws, though several local governments in California and Washington have. The State should continue to collect information about the adequacy of existing programs, developments in the federal regulations, and any new EPR laws that address pharmaceuticals.

2021 - 2025

4.7 Consider other disposal bans. Maryland has already banned a number of items from disposal in landfills. Disposal of scrap tires in a landfill is prohibited unless a waiver is granted by the Secretary of MDE.[94] In addition, controlled hazardous substances, liquid waste, special medical waste, radioactive substances, automobiles, drums and tanks (unless empty and flattened or crushed with the ends removed), animal carcasses from medical research or destruction of diseased animals, untreated liquid septage or sewage, and chemical or petroleum cleanup materials are banned from disposal in municipal solid waste facilities in the State. In addition to electronics and the materials discussed above, the State should inventory other materials for which there is already adequate recycling capacity or for which disposal produces particular environmental harm. Additional materials that may be considered for disposal bans include:

- Latex paint;
- Carpet;
- Metal;
- White goods;
- Gypsum wallboard;
- Wood;
- Asphalt and concrete;
- Cardboard;
- Textiles;
- Batteries; and
- Mercury dental amalgam and other mercury-containing products.

Following the State's inventory and evaluation, the State should impose additional disposal bans.

[92] Secure and Responsible Drug Disposal Act of 2010, P. L. 111-273, 124 Stat. 2858 (2010); 74 Fed Reg. 75784 (Dec. 21, 2012).
[93] U.S. Department of Justice, Drug Enforcement Administration, National Takeback Initiative, http://www.deadiversion.usdoj.gov/drug_disposal/takeback/index.html
[94] Environment Article, § 9-228(f), Annotated Code of Maryland.

2026 - 2030

4.8 Consider product bans for non-recyclable materials. Product bans are used to address materials that are not readily recycled for technical or economic reasons. Product bans prohibit the sale or provision of the covered product by any person within the jurisdiction. This approach is consistent with zero waste principles, which encourage recycling of items that are efficiently recycled, redesign of items that are not, and elimination of items that cannot be redesigned. As Maryland gets nearer to its zero waste goals and most traditional recyclables have been captured, it will need to focus on the items remaining in the waste stream and determine whether reuse or recycling is possible for these materials. For example, some cities in the U.S., including San Francisco, California and Seattle, Washington have prohibited use of non-recyclable and non-compostable food service ware by food vendors and businesses.[95] Washington, DC will specifically prohibit use of polystyrene foam food service products, beginning in 2016.[96]

Objective 5 – Incentivize Technology Innovation and Develop Markets

Background

This objective consists of strategies to make Maryland more attractive to recycling-related research, development, and business, by:

- Reducing regulatory and economic barriers to establishing new recycling-related businesses;
- Supporting burgeoning technologies in waste diversion; and
- Growing in-State markets for recycled materials and recycled products.

In order to meet the zero waste goals, Maryland must ensure there is sufficient capacity to process additional recyclables and sufficient demand for recycled products. Several new technologies for diverting and managing waste are becoming more popular and commercialized in the U.S., including anaerobic digestion and gasification. However, siting new facilities involves capital costs, and to encourage local governments and private businesses to invest in new technologies, Maryland should establish clear regulatory systems and favorable economic incentives.

Incentives and subsidies used to support waste diversion in other jurisdictions include recycling grants for local governments, tax credits, loan guarantees or low-interest loans, grants and cost-share for businesses, technical assistance, and subsidies based on production quantities. (For a discussion and examples of these incentives, along with the funding sources for these programs in other states, see Appendix B.)

Initiatives

[95] San Francisco Food Service Waste Reduction Ordinance, Ordinance 295-06 (2006); Seattle Ordinance 122751 (2008).
[96] D.C. Bill 20-573 (2014).

2015 - 2020

5.1 Review regulatory requirements and provide guidance. Maryland's regulatory requirements applicable to waste diversion facilities should be flexible enough to accommodate quickly evolving technology and new innovations. The State should identify regulatory barriers to siting new types of waste diversion facilities and ensure that there are no unnecessary obstacles. Where a particular process (such as anaerobic digestion) is not specifically addressed in law or regulations, additional authority may need to be sought or additional regulations developed. Guidance documents or permitting assistance may also be useful. Because local issues, such as land use planning, also impact siting of new types of facilities, MDE will seek ways to assist local governments in reducing barriers to new technologies, such as providing sample zoning codes. The Department's review of regulatory requirements applicable to waste diversion facilities should be completed by 2017.

5.2 Support waste diversion research. Maryland should seek opportunities to partner with universities and other centers of research to investigate and test new waste diversion strategies.

5.3 Initiate and fund demonstration projects. The State should engage in partnerships with local governments and private businesses to fund or otherwise support pilot programs for testing new waste diversion strategies.

5.4 Establish a funding system for provision of financial incentives. As discussed in Chapter 1, Maryland currently lacks a funding mechanism to attract and retain innovative waste diversion businesses. The Department and stakeholders should resume discussions and identify the best means of funding these programs, such as solid waste facility permitting fees or a State-wide tipping fee on solid waste disposal.

5.5 Establish by 2018 financial incentives for new reuse and recycling facilities. Incentives for new or expanded reuse, recycling, composting and anaerobic digestion facilities in Maryland may include low-interest loans or loan guarantees, grants, technical assistance, and funding for job training. In addition, many states have used tax credits to encourage investment in recycling infrastructure,[97] including:

- Sales tax exemptions for sales of recycling-related equipment or machinery;
- Property tax credits for construction of new facilities or installation of new equipment; and
- Income tax credits or deductions for equipment investments or employment.

5.6 Collaborate across agencies on business and market development. Maryland's Department of Business and Economic Development (DBED) conducts a variety of business assistance activities and provides information on available tax credits, access to capital, recruitment and training, and assistance with siting of facilities. MDE should work with DBED to develop programs that specifically target prospective recycling businesses and capture the green jobs potential of an expanded recycling, composting and anaerobic

[97] EPA, "State Recycling Tax Incentives," http://www.epa.gov/wastes/conserve/tools/rmd/bizasst/rec-tax.htm

digestion industry in Maryland (see Chapter 2 for discussion of the employment benefits of zero waste).

5.7 Incentivize adoption of new programs by local governments. The State should assist counties and municipalities with startup costs for new or expanded waste diversion programs. This could be accomplished through grants for:

- New food recovery programs;
- Pay-as-you-throw programs;
- Permanent recycling programs for difficult materials such as pharmaceuticals or other types of household hazardous waste;
- Procurement of updated recycling or collection equipment; or
- Enforcement of new disposal bans on recyclable materials.

Objective 6 – Recover Energy from Waste

Background

The goal of this Plan is to minimize the need for all forms of disposal through source reduction, reuse, recycling, and composting. However, zero waste is a long-term goal requiring a variety of legislative, regulatory, policy, and programmatic changes. Even with strong policies in place, profound changes in materials management take time to achieve. New physical infrastructure must be built; markets for recycled materials must expand; and individuals must change their perceptions and habits. Further research and development is still needed to improve recycling of difficult materials.

These realities are reflected in the timeframes set in this Plan. Even under the aggressive interim goals, an estimated 60 million tons of Maryland waste will need to be disposed between 2015 and 2040. In any given year during this Plan's scope, some portion of the waste stream will be beyond what is technologically and economically possible to prevent or recycle. Shrinking this unrecoverable share should always be the primary emphasis of State policies and resources. However, ignoring the interim need for disposal would result in missed opportunities to minimize near-term environmental impacts.

Maryland currently relies heavily on land-filling to manage its unrecovered share of waste. In 2012, land-filling accounted for approximately 63% of all solid waste disposed in Maryland. In the future, disposal should be shifted to technologies that reduce GHG emissions, particularly those that produce clean energy from waste.

Source reduction, recycling, and composting are virtually always environmentally preferable to disposal in landfills or energy recovery facilities. When choosing between energy recovery and land-filling, energy recovery is often the preferred option. This is because energy recovery avoids GHG emissions and conserves energy relative to land-filling. Methane, which composes approximately half of the gas generated in a landfill, is far more damaging (per ton emitted) from a climate change perspective than carbon dioxide, especially in the short term. Energy recovery facilities produce almost no methane and, for many materials, generate lower

overall greenhouse gas emissions than land-filling.[98] Energy recovery facilities also generate electricity, displacing higher carbon fossil fuel-fired generation.

Consistent with the materials management hierarchy, energy recovery should always be coupled with a strong recycling program in which generators have removed as many recyclables as possible. Only non-recyclable wastes should be disposed through energy recovery, and only in conjunction with ongoing efforts to reduce the quantity of waste generated. Evidence suggests that energy recovery can be used successfully in conjunction with aggressive recycling programs. Harford and Montgomery Counties, both of which have energy recovery facilities, are consistently among the top counties for recycling. Across the U.S., a study found that states with energy recovery have recycling rates slightly higher than the national average and that within each state, recycling rates in communities that use energy recovery are generally similar to the statewide average recycling rates.[99] The author of that study concluded that state recycling policies have a more profound impact on recycling rates than whether a community disposes of material through energy recovery or land-filling. Energy recovery facilities may actually enable additional recycling for some materials as they can recover metals not typically captured by recycling programs.

At least some of the shift toward lower GHG-generating forms of disposal could be accomplished with existing infrastructure. As of 2012, Maryland had approximately 300,000 tons of annual excess permitted capacity at its three major energy recovery facilities in Baltimore City, Harford County, and Montgomery County.

In addition to traditional energy recovery, interest has increased in other disposal technologies, including gasification. Gasification converts waste to a synthetic gas ("syngas") using heat (typically 1,100 – 1,800 °F) and limited amounts of oxygen.[100] Syngas is then combusted to generate heat, electricity, or both, or with further processing can be used to create liquid fuels and other chemicals. Gasification results in fewer air emissions than traditional energy recovery, but its use for MSW in the U.S. is still developing.

The State's goal is to reduce disposal of waste over time. Figure 13 provides an example of how the zero waste goals could be combined with reduced reliance on landfills for the small portion of waste still requiring disposal. By 2040, the graph shows 80% recycling and composting and a reduction in waste generation to five pounds per person, per day (discussed further under Objective 1). Accordingly, all forms of disposal decrease significantly over time. Land-filling is phased out gradually, to account for existing capacity and bond repayment timeframes. The remaining in-State disposal is shifted toward gasification and other energy recovery, reflecting a

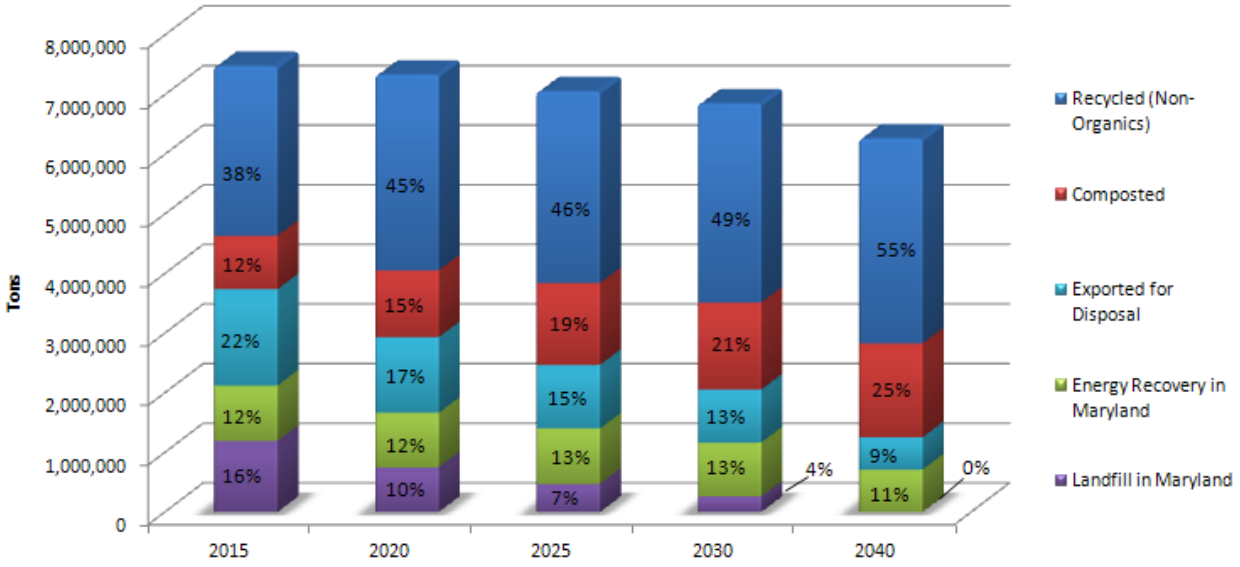
[98] See EPA, WARM Emissions Factors, http://epa.gov/epawaste/conserve/tools/warm/index.html ; Kaplan, P. Ozge et al, "Is It Better To Burn or Bury Waste for Clean Electricity Generation?" Environ. Sci. Technol. 2009, 43, pp. 1711 – 1717 (modeling greenhouse gas emissions per unit of energy production from energy recovery and landfill-gas-to-energy).

[99] Berenyi, Eileen Brettler, PhD., Recycling and Waste-to-Energy: Are They Compatible? 2009 Update (June 2009), http://www.energyrecoverycouncil.org/userfiles/file/2009%20Berenyi%20recycling%20update.pdf

[100] Gershman, Brickner & Bratton, Inc., Gasification of Non-Recycled Plastics From Municipal Solid Waste In the United States (Prepared for American Chemistry Council) (2013), http://plastics.americanchemistry.com/Sustainability-Recycling/Energy-Recovery/Gasification-of-Non-Recycled-Plastics-from-Municipal-Solid-Waste-in-the-United-States.pdf

shift in preference toward GHG emissions-reducing methods of disposal. Toward the end of the planning period, energy recovery begins to decrease as well, as the state nears zero waste and the need for disposal is minimized.

Figure 13: Disposition of Waste, 2015 - 2040[101]



Underway

6.1 Assess and compare environmental impacts of disposal technologies. As new processing and disposal technologies are being applied in municipal settings in the U.S. and abroad, the Department is reviewing the available literature and local experiences to better understand the environmental impacts of each available disposal option.

2015 - 2020

6.2 Encourage anaerobic digestion. Anaerobic digestion generates clean energy from organic materials, along with a digestate that can be recycled into compost, fertilizer or animal bedding. As discussed under Objective 3, anaerobic digestion should be promoted for use on municipal, commercial, and agricultural organic waste streams.

In a number of European countries, AD is also used as a pre-treatment method to stabilize waste prior to sending it to a landfill. Methane can be captured and used for energy and the stabilized digestate can then be disposed, resulting in less formation and emission of

[101] A small amount of land-filling may be necessary, even by 2040, to account for ash generated from energy recovery. Some of this ash would be recycled in road paving, construction aggregate, and similar uses. It is assumed here that the rest would be landfilled out-of-State. This is because at very low levels of land-filling, it is unlikely that in-State landfills would continue to operate solely for acceptance of ash.

landfill gas. This may be another option to reduce greenhouse gas emissions from disposal while the State gradually shifts away from land-filling. However, it is important to remember that source-separation of organics and other recyclables should be maximized. Digestate from AD of mixed waste is not usually recycled because of high levels of contamination, whereas digestate from source-separated organics is useful in a variety of applications.

6.3 Support gasification and other clean energy technologies. The Department should continue to research and track developments in other clean energy technologies. Gasification, for example, can process MSW with fewer air emissions than traditional energy recovery. Interest in gasification is growing in the U.S., including in several Maryland counties. The Department will examine ways to reduce barriers to adoption of gasification. See Objective 5 for other initiatives to support burgeoning technologies.

6.4 Utilize energy recovery for managing solid waste, after maximum removal of recyclables. Due to its greenhouse gas emissions and energy production benefits relative to land-filling, energy recovery should be preferred to land-filling as a disposal method for non-recyclable waste.

6.5 Cease permitting of additional municipal landfill capacity. As capacity for alternatives to land-filling expand, the Department should discontinue permitting of new and expanded municipal landfill capacity. This will enhance incentives to source reduce, recycle, and capture any remaining waste for energy recovery by limiting further investments in landfill disposal.

Objective 7 – Collaborate and Lead by Example

Background

State government has several roles to play in achieving the zero waste goals. First, the State can divert the recyclable materials generated by its agencies. Maryland law requires MDE and other State agencies to develop and implement recycling plans. In 2009, the law was amended to require that agency plans provide for recycling of at a minimum aluminum, glass, paper, and plastic (Chapter 408, Acts of 2009). More recently, Chapter 692, Acts of 2012, increased the recycling rate goal for State government to 30% (from 20%), or a practical and economically feasible rate of at least 15% (from 10%). The new plans to achieve the increased rate must be implemented by July 1, 2014.

While State government as a whole surpassed its recycling goal of 20% for 2012, there is significant room for improvement. In 2012, the State agency recycling rate was 28.1%, which lags behind the overall Statewide recycling rate of 45.2%.[102] While some State agencies performed extremely well (the highest recycling rate was more than 84%), others failed to meet

[102] For calendar year 2012 data, a change was made to the volume-to-weight conversion factor used by some State agencies when estimating the amount of waste disposed. As a result, State agencies using the conversion factor would show a recycling rate reduction, compared to 2011, even if the amount of material recycled remained constant.

the goal. The State has taken several recent actions to improve State agency recycling. The standard State lease for building space has been amended to include language that requires the lessor to collect and properly recycle materials in compliance with the recycling plan. [103] MDE serves as a recycling information resource for State agencies by maintaining a State Agency Recycling web page, holding meetings of State agency recycling coordinators, publishing a State agency newsletter, and conducting site visits to discuss issues, present ideas, and offer assistance to improve recycling at State agencies.

In addition, in 2013 MDE began collection of organics (food scraps and soiled paper) from its office building for composting and presented information on its experience to other State agencies. Maryland should leverage the visibility of State government to provide an example for the rest of the State.

The State is a consumer of products and has the opportunity to support markets for recycled materials through its procurement choices. Maryland law currently requires the Secretary of General Services to purchase, or approve for purchase, recycled paper. The Green Maryland Act of 2010 (Chapter 593, Acts of 2010), increased the amount of recycled paper that must be purchased to 90% of all paper purchased (from 40%). Paper is considered "recycled" if its recycled content is least 80%.[104] The law also requires agencies that maintain public land to give consideration and preference to the use of compost in landscaping.[105] The Maryland Green Purchasing Committee, also created by the 2010 Act, has developed a Best Practices Purchasing Manual and Purchasing Guidelines for environmentally preferable purchasing (EPP).[106] A 2014 law (Chapter 604) eliminated a 5% price preference for recycled products in favor of a requirement that the Green Purchasing Committee adopt EPP specifications based on a broader range of environmental impacts throughout the product's lifecycle. While the Committee has already begun establishing EPP specifications, the law will strengthen this effort by requiring each State agency to adopt the specifications to the extent practicable.

Initiatives

Underway

7.1 Increase environmentally preferable procurement and management of electronics. The State Electronics Challenge (SEC) is a voluntary program that assists State and local governments in charting a path toward environmentally responsible management of electronic equipment. The program provides a checklist of actions to be taken in three life-cycle phases: procurement; operation and maintenance; and end-of-life management. It also provides informational resources and allows members to track their progress through a yearly individualized sustainability report. MDE and the Maryland Department of Transportation currently participate in the SEC.

[103] DGS, Standard State Lease Conditions, http://www.dgs.maryland.gov/RealEstate/StandardStateLeaseGeneralConditions.pdf
[104] State Finance and Procurement Article, §14-402, Annotated Code of Maryland.
[105] State Finance and Procurement Article, §14-409, Annotated Code of Maryland.
[106] DGS, Maryland Green Purchasing, http://www.dgs.maryland.gov/Procurement/Green/index.html

Legislation passed in 2012 requires that any procurement contracts awarded by State units for electronics recycling go to companies that are certified by R2 or E-Stewards or that meet similar standards (Chapter 372, Acts of 2012). This is an important step to ensure that recycling of State electronics is done responsibly and is also one of the key requirements under the SEC program. The provision became effective in October 2014.

7.2 Fully implement environmentally preferable procurement specifications. EPP specifications for many types of products have already been established by the Maryland Green Purchasing Committee and are available on the Department of General Services website.[107] All State agencies should strive to fully implement the EPP specifications when purchasing products and services for State use.

2015 – 2020

7.3 Increase procurement and use of compost. Increased procurement of compost by the State was a recommendation in the Composting Workgroup Report published in 2013.[108] The report contains recommendations for increasing use of compost, including:

- The State should endorse a variety of compost uses in its guidance and manuals, including the Soil Erosion and Sediment Control Manual, Stormwater Design Manual, and State Highway Administration Materials and Technology Division list of approved compost.
- MDE, MDA, and MES should work with the State Highway Administration Recycled Materials task force to increase the use of compost.
- MDE and MES should work with the Department of General Services (DGS) to develop a State contract for MDA-registered compost. A possible price preference for Maryland-produced compost should be considered.
- The State should set Maryland-generated compost procurement targets by 2020.

7.4 Seek opportunities for regional collaboration. Collaboration among states in the region is important in working toward zero waste for several reasons. Some waste diversion strategies or issues are best addressed through a consistent, regional approach. One example is EPR programs. EPR is more efficient when it is consistent across jurisdictions because producers are able to develop one recovery program and producer organization for use in all locations. For many issues, industry prefers a level playing field across the region in order to avoid having to navigate inconsistent requirements in each place where a product is sold.

Second, states within a region can learn from each others' experiences in implementing new waste diversion strategies. Members of a regional collaboration can work together to develop model legislation and regulations and share the costs of research, outreach, and education. One example of an existing regional partnership that conducts these activities is

[107] DGS, Maryland Green Purchasing, Specifications for Environmentally Preferable Purchasing, http://www.dgs.maryland.gov/GreenOperations/GreenPurchasing/Guidelines/specifications.html

[108] MDE, Composting Workgroup Final Report (2013), http://mde.maryland.gov/programs/Land/RecyclingandOperationsprogram/Publications/Documents/composting_workgroup_final_report_1-2013000%20(1).pdf

the Northeast Recycling Council (NERC), composed of Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. Coordinating programs with EPA Region 3 and the other Region 3 states is another opportunity for State agencies to collaborate with others in the region.

7.5 Create a State government source reduction checklist. Maryland's waste diversion rate is calculated as the recycling rate plus a source reduction credit up to 5 percent. This source reduction credit is derived from county responses on a source reduction checklist. The checklist gives credit for activities such as promoting home composting or providing technical assistance on source reduction. A similar checklist should be created by MDE for use by State government agencies to track and encourage source reduction. This checklist should be produced, distributed and utilized by 2016.

7.6 Progressively phase in higher recycled content requirements for paper.. Maryland should progressively phase in higher recycled content requirements for paper to an eventual requirement for 100% purchase of paper containing 100% recycled content.

7.7 Increase State government recycling rates. As discussed above, the mandatory State government recycling rate increased to 30% on July 1, 2014 (2015 will be the first full reporting year under the new rate). In order to serve as an example for the State, State agencies should strive for a rate of 50% by 2020. If a recycling rate of 50% in the aggregate is not met by 2020, a new schedule for increases in the mandatory State agency recycling rates at three-year intervals should be established in order to encourage continuous improvement. State government should reuse, recycle or compost 90% of its waste by 2030.

7.8 Markedly increase composting and anaerobic digestion of State government's organic waste. State agencies should immediately begin to identify properties that may be available for on-site composting and anaerobic digestion of organics. Examples may be State correctional facilities, universities, or State Highway Administration properties. Where this is not feasible, agencies should establish organics collection programs in major offices for transport to off-site composting or anaerobic digestion facilities. Sixty percent of State government-generated organic waste should be recycled, composted, or digested by 2020.

Objective 8 – Conduct Education and Outreach

Background

From 2010 to 2011, MDE headed a study group tasked with addressing various topics associated with increasing waste diversion in Maryland, pursuant to Chapter 719, Acts of 2010. The Study Group, made up of local government solid waste and recycling departments and others in Maryland's recycling industry, emphasized the need for sustainable funding of outreach and education efforts. Increasing waste diversion requires changes in public perception and behavior, so ensuring the success of the initiatives listed in this Plan will require effective outreach.

While many counties and municipalities in Maryland conduct outreach and education related to their own recycling programs, it is also important to convey a consistent, Statewide message about waste diversion. MDE provides recycling and source reduction information to the public through its website and conducts an annual recycling-themed sculpture contest for high school students. However, education and outreach efforts need to be substantially increased in the future to support the zero waste goals.

For outreach initiatives related to organics, see Objective 1 above. For outreach initiatives related specifically to source reduction, see Objective 5.

Initiatives

2015 - 2020

8.1 Seek sustainable funding for outreach. The Study Group that met as a result of Chapter 917, Acts of 2010 discussed the difficulty of maintaining consistent State or local outreach programs given funding constraints. The Group's final report noted that many of the counties and municipalities have seen declining budgets for education and outreach. MDE has been unable in recent years to fund outreach or education activities. The Group discussed a variety of potential funding sources and mechanisms and recommended that stakeholders and legislators further evaluate options for achieving long-term funding.[109] These discussions should be resumed, with assessment of possible permitting fees or other funding options.

8.2 Provide funding to local governments for outreach activities. The State should provide grants to support local governments in their own outreach, particularly where it is needed to increase awareness of a new recycling or source reduction program.

2021 – 2025

8.3 Establish a zero waste business recognition program. As local and State governments have begun to set zero waste goals, businesses have done the same, some with great success. A recognition program for businesses that have stated or achieved zero waste goals would encourage adoption of zero waste goals and provide case studies for others to use. This program could build on the success of Maryland's Green Registry, which showcases organizations conducting a variety of sustainable activities. In 2013, the U.S. Zero Waste Business Council launched the country's first third-party zero waste business certification program.[110]

8.4 Conduct outreach at schools. Schools generate recyclable materials such as paper and food scraps, but MDE currently lacks information about how many schools participate in

[109] MDE, Solid Waste Management – Recycling and Source Reduction Study Group Final Report (2013) http://mde.maryland.gov/programs/Land/RecyclingandOperationsprogram/Publications/Documents/SW%20Task%20Force%20Final%20Report%20FINAL%207%2031%2013.pdf .
[110] USZWBC, Certification, http://www.uszwbc.org/certification

recycling programs and to what extent. Regular interaction with Maryland schools could help gauge participation and improve existing programs. In addition to increasing recycling in schools, inclusion of waste diversion issues in school curricula can be used to encourage recycling behavior of students and their families at home. Dedicated outreach staff should be hired to conduct outreach to schools and MDE should work with the Maryland State Department of Education and counties to identify and train sustainability coordinators for each school.

8.5 Conduct business recycling assistance. Businesses may face particular challenges in setting up recycling programs, including widely varying waste streams, staff training and turnover issues, and the need to contract individually for recycling and solid waste services. Outreach targeted to businesses could help respond to some of these issues, as well as provide MDE with feedback about the current status of business recycling and any obstacles preventing full participation. Staff or funding for contracts should be provided to conduct business assistance.

Appendix A – Selected Case Studies

Case Study: Montgomery County Business Recycling and Reporting

Montgomery County's business recycling and reporting regulation was adopted in 1993 and updated in 2005. It requires all businesses to recycle certain items and requires larger businesses (with more than 100 employees) to submit a recycling plan to the County. In addition, larger businesses must report on their recycling activities annually, including tons of each recycled material and tons of disposed waste. Annual reports must also include the size and number of collection containers, the hauler used, and the pickup frequency. The three-page report form may be submitted online or by mail. Businesses are responsible for requesting all necessary information from the hauler. The County also requires semi-annual reporting by licensed haulers and collectors.[111]

Case Study: Packaging EPR in Belgium

Belgium established its packaging EPR law in 1996 in response to a 1994 European Union directive.[112] The producer organization, Fost Plus, fully funds recovery of packaging through contracts with municipalities and private entities. Municipalities are given the first opportunity to contract at a price that is based on average costs across all municipalities. About half of Belgian municipalities choose to operate packaging recycling programs under the EPR system. Fost Plus has monopoly status as the only producer organization and its members account for 92% of the market share. Glass is collected at dropoff sites, paper is collected once per month curbside, and plastic bottles, metal cans, and drink cartons are collected twice per month at curbside.[113] The goals for the program are 80% recycling and 90% recovery (recycling plus waste-to-energy). In 2011, the recycling rate for packaging was 80.2% (the highest in the EU) and the recovery rate was 96.9%.[114] Producers pay fees per kilogram of packaging, with reusable packaging being free, and more easily recyclable packaging types costing less than difficult-to-recycle materials. For example, in 2014, the fee for cardboard is less than 1 cent/pound, while the fee for plastic is about 16 cents/pound and the fee for "complex" packaging that is a mixture of metal or glass and other materials is about 25 cents/pound.[115]

Case Study: Waste Diversion Research and Innovation in Edmonton, Alberta

[111] Montgomery County, Business Recycling and Waste Reduction, http://www6.montgomerycountymd.gov/swstmpl.asp?url=/content/dep/solidwaste/education/sorrt/index.asp
[112] European Parliament and Council Directive 94/62/EC (1994).
[113] PRO Europe, Uniformity in Diversity (2011), http://pro-e.org/files/PRO-EUROPE_Producer-Responsibility-in-Action_web-version_final_150811.pdf
[114] Eurostat, Packaging Waste, http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do
[115] Using exchange rate from December 13, 2013, 1 EUR = 1.372 USD. Fost Plus, Les tarifs Point Vert 2014, http://www.fostplus.be/SiteCollectionDocuments/Leden/GP%20tarieven/Tarifs%20Point%20Vert_2014.pdf

Alberta's capital, the City of Edmonton, adopted a zero waste goal and plan in 2011. The City is a leader in waste diversion technology and research. Its unique Edmonton Waste Management Centre is a centralized campus of waste diversion facilities and research centers, including a materials recovery facility (MRF), a paper and textile recycling facility, an electronics recycling facility, a C & D recycling center, a processing center to pull organics and metals from MSW, a composting facility, and a waste-to-biofuel gasification facility.[116] The waste-to-biofuel facility will create liquid fuels (ethanol and methanol) as well as residual heat and syngas that will be used in a district heating loop of a nearby urban community. The City's research center develops new technologies, conducts applied research, and provides training for solid waste professionals. In addition, a new Advanced Energy Research Facility will house pilot- and bench-scale facilities to conduct gasification and gas-to-liquid research. Funding for this project was provided by Alberta's statutorily created funding agency for energy and environment innovations.[117] Edmonton projects that residential waste diversion will reach 90% upon full operation of the waste-to-biofuel facility.

Case Study: Massachusetts Organics-to-Energy Program

The Massachusetts Clean Energy Center (CEC) was created by statute in 2009 to provide financial and technical support to foster growth in Massachusetts' renewable energy industry. The Center is funded through a fee on electric ratepayers.

Within CEC, the Organics-to-Energy program supports projects such as anaerobic digestion that divert organics from landfills while generating energy. The program offers financing for construction, pilot programs, and technical assistance, such as retention of consultants to conduct feasibility studies or evaluate proposals. CEC also provides information on other financing options, tax credits, net metering, renewable portfolio standards, and the Massachusetts' Green Loan Program. [118]

More than $2.3 million in grants were issued for organics-to-energy projects in FY 2013, including five construction grants for new anaerobic digesters, all of which will accept food.[119] This effort aligns with Massachusetts' decision to phase in a ban on disposal of commercial food scraps. A 2013 report showed that the clean energy industry in the Commonwealth expanded by 24% over the past two years and the number of clean energy jobs increased by almost 12%.[120]

Case Study: Construction and Demolition Debris Recycling in San Francisco

[116] City of Edmonton, Edmonton Waste Management Centre, http://www.edmonton.ca/for_residents/garbage_recycling/edmonton-waste-management-centre.aspx
[117] Edmonton Waste Management Utility 2012 Annual Report (2013) http://www.edmonton.ca/for_residents/PDF/2012_Waste_Management_Services_Annual_Report.pdf
[118] Massachusetts Clean Energy Center, Commonwealth Organics to Energy, http://www.masscec.com/programs/commonwealth-organics-energy
[119] Massachusetts CEC, MassCEC Awards $2.3 Million for Organics-to-Energy Projects (Jul 12, 2013), http://www.masscec.com/news/masscec-awards-23-million-organics-energy-projects
[120] Massachusetts CEC, 2013 Clean Energy Industry Report, http://www.masscec.com/content/2013-clean-energy-industry-report.

The San Francisco Department of the Environment enacted the Construction and Demolition Ordinance in 2006, amending the Building Code, Health Code, and Police Code.[121] The ordinance requires all C&D debris removed from a construction or demolition project to be recycled or reused. C&D waste material is prohibited from being sent for disposal in a landfill. C&D material that is source separated must be taken to a facility that recycles those materials. Mixed C&D debris must be transferred by a registered transporter to a registered facility. These registered facilities are monitored by the Department of the Environment and must sort the mixed materials to achieve a minimum diversion rate of 65%. For a full demolition, a Demolition Debris Recovery Plan (DDRP) must be submitted to and approved by the Department of the Environment. The completed plan must demonstrate a minimum demolition waste diversion rate of 65%.

Failure to comply results in registration suspensions, civil and criminal penalties, and significant fines. At its passage, the ordinance was anticipated to prevent 100,000 tons of waste annually that would otherwise be disposed of in a landfill.

[121] San Francisco Ordinance 27-06

Appendix B –State Recycling Incentives and Subsidies

Local Government Tonnage Grants

Description

Recycling tonnage grants are used to encourage local governments to increase the amount of material captured for recycling through innovative programs. The tonnage grants provide a set award amount for each ton of material recycled by the county or municipality and may also take into account the recycling rate.

Examples

- **Pennsylvania Recycling Performance Grant** – Available each year, this program provides payments to local governments based on residential and commercial recycling tonnages, a "bonus award" based on the recycling rate, and an extra incentive applicable to high levels of commercial recycling. Pennsylvania provided more than $15 million in tonnage grants to local governments in 2011.[122] The program is funded by a fee on MSW entering landfills or incinerators.[123]

- **New Jersey Municipal Recycling Tonnage Grant Program** – The New Jersey program is based on recycling tonnage and emphasizes key materials by offering different per-ton payments based on material type. For example, a local government receives approximately $5 for one ton of electronics recycling, while it receives roughly $2 for one ton of plastic containers.[124] More than $13 million was awarded in 2011.[125] The program is funded by a $3 per ton fee on solid waste accepted for disposal or transfer.

Local Government Program Development Grants

Description

These grants provide incentives for local governments to take on new recycling initiatives or to improve existing programs. They fund startup or equipment costs for implementing programs such as curbside recycling, organics collection, and pay-as-you-throw (PAYT).

Examples

- **Massachusetts Sustainable Materials Recovery Program Municipal Grants** – This annual program provides funding for projects in designated categories, including: establishing PAYT; hiring staff to enforce a disposal ban on recycling requirement; purchasing carts for implementing a curbside recycling program; purchasing drop-off recycling or organics collection equipment; conducting school recycling assistance; and making "targeted small scale investments" (public space recycling bins, etc.)

[122] Pennsylvania DEP, Act 101, Section 904 Grants, http://files.dep.state.pa.us/Waste/Recycling/RecyclingPortalFiles/Documents/CY2011_904.pdf
[123] Pennsylvania DEP, Act 101, http://www.dep.state.pa.us/dep/deputate/airwaste/wm/recycle/facts/act101.htm
[124] New Jersey DEP, Recycling Tonnage Reporting Guide, http://www.nj.gov/dep/dshw/resource/Tonnage/guide.pdf
[125] New Jersey DEP, 2011 Recycling Tonnage Grant Payout, http://www.nj.gov/dep/dshw/recycling/stat_links/2011payout.pdf

Massachusetts awarded approximately $2.1 million under the program in 2013.[126] The program is funded through a portion of proceeds from energy recovery facilities' sales of Waste Energy Generation attributes under the State's renewable portfolio standard.

- **Pennsylvania Recycling Program Development and Implementation Grants –** The program reimburses local governments for 90% of the cost of developing and initiating various programs. Past awards have covered projects related to curbside recycling, newsprint utilization for animal bedding, leaf composting, recycling education, apartment recycling, commercial recycling, plastic processing, and home composting, among others.[127] The program is funded by a $2 per ton fee on MSW entering landfills or incinerators.
- **California Beverage Container Recycling Payment Program –** This program provides payments to local governments to fund beverage container recycling or litter abatement. The program is unique in that it is not a competitive grant program - all local governments are eligible for payments annually, with the quantity based on population.[128] In FY 2013, $10.5 million was distributed to local governments under the program. Funding for the program comes from processing fees paid by manufacturers under the beverage container deposit law, as well as unredeemed deposits.

Loans

Description

Loan programs offer low-interest loans or loan guarantees to finance the costs of starting or expanding a recycling or renewable energy facility. This can be particularly helpful for new and innovative technologies, where projects may otherwise have difficulty obtaining funding due to perceived risk.

Example

- **California Recycling Market Development Zone Loan Program** – The program offers low-interest loans to businesses that use wastes to manufacture products. The businesses must be located in certain areas (designated "development zones"). The loans may be up to 75% of project costs or $2 million. Previous recipients have included composting and vermicomposting businesses. Participating businesses also receive assistance in identifying markets, siting, obtaining permits, and sourcing feedstocks. Total annual loan amounts have ranged between $2 million and $11 million.[129]

Grants

[126] Massachusetts DEP, Sustainable Materials Recovery Program, http://www.mass.gov/eea/docs/dep/public/committee-4/smrpupdt.pdf
[127] Pennsylvania DEP, Recycling Program Development and Implementation Grants, http://www.portal.state.pa.us/portal/server.pt/community/financial_assistance/14065/recycling_program_development_and_implementation_grants_/589534
[128] CalRecycle, City/County Payment Program, http://www.calrecycle.ca.gov/BevContainer/Grants/CityCounty/default.htm
[129] CalRecycle, RMDZ Loan Count and Amounts by Fiscal Year, http://www.calrecycle.ca.gov/RMDZ/Reports/Charts/LoanAmtYrChart.aspx

Description

Grants offset costs to construct, expand, or purchase equipment for a recycling or renewable energy facility. They are optimally suited for technologies that can be self-sustaining after the initial construction phase, or can be combined with ongoing subsidies to help sustain less developed technologies.

Examples

- **Massachusetts' Commonwealth Organics-to-Energy Construction and Pilot Grants** – This program through the Massachusetts Clean Energy Center (MassCEC) is used primarily to fund anaerobic digestion projects. Grants are awarded up to $400,000 or 25% for construction projects and $200,000 or 50% for pilot projects for new technologies. For construction projects using proven technologies, there is also a cost-effectiveness requirement – costs must be less than $1.50/kWh. In FY 2013, the program issued five construction grants totaling $1.75 million for anaerobic digesters, all of which will accept at least some food scraps. Two of the digesters will be designed to accept expired supermarket food.[130] MassCEC is funded through a "systems benefit charge" paid by electric ratepayers of investor-owned utilities.[131]

- **California Greenhouse Gas Reduction Grants –** The Governor's 2014-15 Budget included a new funding program for recycling and organics diversion projects that would reduce GHG emissions. The project would have three components: (1) an organics grant program for construction or expansion of organics recycling facilities; (2) a recycled fiber, plastic, and glass grant program for construction or expansion of manufacturing facilities using these materials; and (3) a loan program for composting, anaerobic digestion, or manufacturing projects. The programs are unique in that they would score applications in part based on the amount of GHG emissions reductions. Approximately $15 million would be awarded for organics grants, $5 million for fiber, plastic, and glass grants, and $10 million for loans. [132]

- **North Carolina Recycling Business Development Grants –** This annual program offered by North Carolina's Recycling Business Assistance Center provides small grants to recycling businesses in the State, up to a maximum of $40,000 per project with 50% matching funds.[133] The grants may cover investments in equipment or buildings for the collection, processing, or end-use of recyclables. In 2013, awards totaled $1.1 million. Funding for the program is provided from a variety of sources, which have included U.S. EPA grants, the State's $2 per ton solid waste tax (adopted in 2007), and fees on purchase of white goods and tires.

Feasibility Studies and Technical Assistance

[130] Massachusetts CEC, MassCEC Awards $2.3 Million for Organics-to-Energy Projects, Jul 12, 2013, http://www.masscec.com/news/masscec-awards-23-million-organics-energy-projects
[131] Massachusetts CEC, About MassCEC, http://www.masscec.com/about
[132] CalRecycle, Proposed Greenhouse Gas Reduction Grant and Loan Programs, http://www.calrecycle.ca.gov/Climate/GrantsLoans/
[133] North Carolina DENR, Financing Tools for North Carolina Recycling Businesses, http://portal.ncdenr.org/web/deao/rbac/financing

Description

In technical assistance programs, the State assists current or prospective waste diversion businesses or local governments in planning or assessing the feasibility of proposed projects. Assistance may include waste characterization studies, cost analyses, business planning, market research, permitting assistance, siting, and sourcing inputs. Assistance may be provided by the state or by a State-funded contractor.

Examples

- **Massachusetts' Commonwealth Organics-to-Energy Program Feasibility Studies** – The Organics-to-Energy Program, discussed above, also provides grants for feasibility studies for "technologies that convert source-separated organic materials into electricity and/or heat while minimizing liquid or solid byproducts requiring disposal."[134] The maximum grant is $40,000. In Fiscal Year 2013, approximately $625,000 was awarded for feasibility studies and other services.[135]

- **Zero Waste Business Assistance Programs** – A number of local governments and other organizations provide consulting and technical assistance to businesses that are seeking to implement zero waste plans. Austin, Texas provides consulting and advice, training, compliance assistance, and on-site waste assessments to businesses for free.[136] San Francisco, California provides an online toolkit for zero waste businesses, including training, a guide for implementing zero waste in commercial office buildings, signs, posters, fliers, case studies, and videos. In addition, the City's Commercial Zero Waste Team provides customized assistance to businesses upon request.[137]

Research, Demonstration, and Pilot Funding

Description

Grants for research and development projects can assist with testing of technologies that are not yet available at full scale. Pilot funding can also help local governments wishing to test adoption of a new program (such as food composting) before making full-scale investments.

Example

- **New Jersey Food Waste Recycling Demonstration Project Gran**t – New Jersey collects a $3 tax on each ton of solid waste accepted for disposal or transfer at solid waste facilities. Five percent of the proceeds may go to colleges and universities for recycling demonstration, research, or education. The Food Waste Recycling Demonstration Grant was established under that authority and provides grants (up to $20,000) for colleges and universities to develop food waste diversion programs on campus. Permissible projects

[134] Massachusetts CEC, Commonwealth Organics-to-Energy Feasibility Studies, http://www.masscec.com/solicitations/commonwealth-organics-energy-feasibility-studies
[135] Massachusetts CEC, MassCEC Awards $2.3 Million for Organics-to-Energy Projects, Jul 12, 2013, http://www.masscec.com/news/masscec-awards-23-million-organics-energy-projects
[136] Austin, Texas, Zero Waste Business Services, http://austintexas.gov/department/zero-waste-business-services
[137] San Francisco, Zero Waste Toolkit for Successful Participation, http://www.sfenvironment.org/article/business-recycling-and-composting/technical-assistance-for-sf-businesses-restaurants-office

include composting, pelletization (for animal feed), and biofuel/bioenergy production systems. The total funds allocated for the program were $200,000.[138]

Performance-Based Payments

Description

Performance-based payments provide ongoing subsidies, usually in an effort to increase the competitiveness or sustainability of a new technology. Payments are usually based on units of production. While typically used for energy-generating technologies, similar incentives could be applied (based on tons) for other types of recycling businesses.

Examples

- **NYSERDA Customer-Sited Anaerobic Digester Gas-to-Electricity Program** – This program is available to new AD installations that are sited at an electric customer, with the electricity used on site. The program includes a performance incentive of $.025/kWh for 10 years. Various technologies to remove hydrogen sulfide from biogas are also eligible for an incentive of $.0023 - .004/kWh. Finally, the program includes "capacity incentives" which are one-time payments for installation of the digester, and interconnection incentives, which offset the review or implementation of interconnection to the electrical grid. Each project may receive up to $2 million in incentives. For the program running through 2015, a total of approximately $20.4 million is available.[139]

- **South Carolina Biomass Energy Production Incentive –** For facilities placed in service after 2008, South Carolina offers an incentive payment of $0.01/kWh or $0.30/therm of electricity or thermal energy produced for the first five years of production. The maximum payment is $100,000 per year, per taxpayer. Biomass includes wood, wood waste, agricultural waste, animal waste, sewage, landfill gas, and other organic materials, not including fossil fuels.[140]

- **Connecticut Anaerobic Digestion Pilot Program –** The program provides several forms of funding assistance for new anaerobic digestion projects. One funding option is a power purchase incentive payment, which pays a fixed amount per kWh for power sold to customers over a period of six years. Other options under the program include loans, guarantees, and grants. The total amount allocated under the 2013 – 2015 program is $5 million.[141]

- **Feed-in Tariffs** – A feed-in tariff guarantees the producers of electricity can sell the electricity through a long-term contract to a utility company at a set price that is meant to reflect the costs of production and incentivize increases in renewable energy production.

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[138] New Jersey DEP, FY'11 Food Waste Recycling Demonstration Grant Program – Round 2 Procedural Guide and Application Form, http://www.nj.gov/dep/dshw/recycling/food%20waste%20guidelines.pdf

[139] NYSERDA, PON 2828 Renewable Portfolio Standard Customer-Sited Tier Anaerobic Digester Gas-to-Electricity, https://www.nyserda.ny.gov/Funding-Opportunities/Current-Funding-Opportunities/PON-2828-Renewable-Portfolio-Stand-Customer-Sited-Tier-Anaerobic-Digester-Gas-to-Electricity.aspx

[140] South Carolina Code, 12-63-20(B).

[141] Connecticut Clean Energy Finance and Investment Authority, Request for Proposals: Anaerobic Digestion Projects, http://www.energizect.com/sites/default/files/uploads/V1%20S103_11-80%20AD%20Rolling%20Enroll%20%28final%206-14-13%29.pdf

California, for example, passed legislation creating a 250 MW total feed-in tariff for bioenergy, including biogas from municipal organic waste diversion (anaerobic digestion and gasification). [142]

Tax Credits

Description

Various tax incentives exist for the purchase of recycling-related equipment or production of renewable energy. Tax credits and exemptions may apply to property, sales, or income taxes. While some states have tax incentives specific to recycling equipment or activities, more general tax credits, such as those for manufacturing equipment, may also be helpful to recycling-related businesses.

Examples

- **North Carolina Tax Incentives** – North Carolina offers special tax treatment for facilities and equipment used for recycling or resource recovery. To be eligible the facility must be inspected and certified. Once certified, the property is exempt from property tax. For corporate State income tax, the deduction for purchase of recycling-related equipment may be amortized over 60 months (as opposed to the normal schedule of depreciation over 15 – 30 years). Finally, the equipment and facilities may be deducted under certain methods of calculating the tax base for the franchise tax.[143]

- **Virginia State Income Tax Credit** – Certain taxpayers may receive a tax credit on State income tax for machinery and equipment used to process recyclable materials. The credit is 10% of the original purchase price of the equipment, can be claimed up to 40% of the total tax liability for any one year, and can be carried forward 10 years. Virginia DEQ must certify that the equipment is "integral to the recycling process."[144]

[142] California PUC, SB 1122: Bioenergy Feed-in Tariff, http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/SB_1122_Bioenergy_Feed-in_Tariff.htm
[143] North Carolina DENR, Tax Provision Information, http://portal.ncdenr.org/c/document_library/get_file?uuid=e08235a2-3cb2-4db0-a730-93f52780314a&groupId=38361
[144] Virginia DEQ, Recycling and Pollution Control Tax Incentive Programs, http://www.deq.virginia.gov/Programs/LandProtectionRevitalization/RecyclingandLitterPreventionPrograms/TaxCredits.aspx