

Appendix I

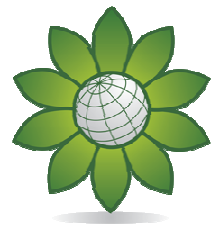
A. Environmental Benefits of Recycling



The benefits of recycling stem from four sources: the value of the recycled material in its reuse; the reduction in the waste requiring collection, transportation, processing, and disposal; the reduction in raw materials required to manufacture products; and the energy saved in processing the raw materials to the point of manufacturing use. The reuse value of the material is reflected in its market price, although, with an average recyclables net market value (after transportation and processing) close to zero, the chief benefit of recycling for consumers is the avoided cost of disposal. This diverted tonnage is expected to increase during the 10-year planning period (2011-2021), during which it is estimated that nearly 690,000 tons of waste will be recycled. If this recycled material was landfilled instead, it would have a disposal cost in excess of \$36 million (based on an average landfill tipping fee of \$53/ton). Instead, the recycled material is used again in a variety of useful products, thus saving the raw materials (and the energy required to process the raw materials) that would normally be needed to produce those products.

There are many important benefits gained from recycling, including economic and environmental benefits which have Regional, national, and global significance. According to the US EPA, recycling processors and manufacturers account for over \$100 billion in revenue. The EPA states that “the use of recycled materials spurs innovation, a key to long term economic growth.” Investments in recycling collection, equipment and the recycled products manufacturing companies themselves, also filter through the economy and contribute to economic growth. The social and environmental benefits of recycling are just as important since they reduce pollution, save energy, and reduce greenhouse gas emissions. Recycling and buying recycled products are important, easily achievable strategies to combat climate change.

According to the EPA, the U.S currently recycles nearly 32 % of its waste, which reduces an amount of greenhouse gases equal to removing 39.6 million cars from the road. Increasing the recycling rate to 35% nationwide would reduce greenhouse gas emissions by an additional 5.2 million metric tons of CO₂ equivalent. Data analyzed by the Northeast Recycling Council (NERC) shows that Pennsylvania saved 9 million metric tons of CO₂ equivalents by recycling 4.9 million metric tons of waste in 2005.



For more statistics, see the following website:

http://www.epa.gov/osw/nonhaz/municipal/pubs/msw_2010_rev_factsheet.pdf

Although there are disagreements about the exact quantification of environmental benefits from recycling, we can say for certain that recycling saves resources including trees, metal, oil, natural gas and various materials used in the manufacturing process. It saves energy, and reduces pollution. It creates sustainable jobs both locally and nationally. It is an important engine for economic growth and prosperity. It is an easily achievable climate-change

strategy that most Pennsylvanians can understand and appreciate. The 300,000+ tons of recyclables collected and processed in the five-County Region since 2005 have contributed significantly to Pennsylvania's economy and environmental health. They serve as a strong foundation for future success.

The Northeast Recycling Council, a group comprised of ten states including Pennsylvania, developed a calculator to assess the environmental benefit of various recycling activities on a state by state basis. These estimates are useful for local officials as well as for businesses to use in analyzing the results of their recycling efforts, and to convey to the general public the benefits of their activities in quantifiable terms. Specific environmental benefits to the Region have been estimated using the NERC calculator (see Appendix B for complete report). To summarize this report, the environmental savings associated with recycling that occurred throughout the Region in 2009 can be put in terms of Savings Equivalencies, as follows:

- Net Greenhouse Gas savings from Curbside Recycling = 27,070 metric tons carbon equivalency
- Net Energy Savings from Curbside Recycling = nearly 700,000 million BTUs
- Gasoline saved = nearly 5,680,000 gallons
- Coal saved from recycling steel and glass – nearly 8,300 tons
- Landfill Space saved by recycling = more than 72,500 CY
- Equivalent number of tree seedlings grown = nearly 1,625,000
- Energy savings in terms of average households/year = nearly 6,900

As can be seen, the equivalent environmental savings associated with recycling are quite substantial. In addition, there is a strong economic benefit to businesses associated with “green” markets created by access to recycled materials. The US EPA states that “recycling means business” and a recent NERC study backs this up with strong data. According to a 2008 NERC study of five Northeast states (Pennsylvania, New York, Maine, Massachusetts and Delaware), recycling industries employ over 104,000 workers in businesses that pay wages comparable to other industries, generating gross receipts in excess of \$35 billion, with \$4.2 billion in payroll. These data substantiate that recycling works both throughout Pennsylvania and in the local five-County Region.

B. Definition of materials addressed by Act 101



Newsprint – Newsprint or newspaper is primarily generated in the residential sector. Post-consumer waste newspaper is called “old newspaper” or “ONP”. ONP can be recycled back into newsprint. It can also be made into cellulose insulation, animal bedding, mulch, low-grade copy and computer paper, and paperboard. Paperboard is a trade term that includes all cardboard types, such as corrugated cardboard and tablet backings, as well as the paper lining on gypsum wallboard. ONP can also be shredded and used as a bulking agent in composting wet organic wastes, such as sludge or manure.

Corrugated Paper – Corrugated paper, referred to in the recycling industry as “old corrugated containers” or “OCC”, composed primarily of corrugated cardboard boxes, also comprises a significant portion of the municipal waste stream. The majority of it is generated in the commercial sector. Recovery of OCC is conducted by the commercial waste generators and private haulers to reduce disposal costs and potentially earn modest sales revenue. Recovered OCC is mixed with virgin pulp to make new corrugated. It can also be used in the manufacture of other types of paperboard.



High Grade Office Paper – High grade paper includes computer print-out, office papers, and ledgers. Most of it is found in the commercial sector, particularly in office buildings, where it can comprise the majority of the office’s waste stream. Computer printout and white ledger can be made back into high grade paper. However, to make bright white paper requires that the recycled fiber be supplemented with a large percentage of virgin pulp. A common use is in the manufacture of tissue products such as paper towels and toilet paper. High grade paper is also used to make paperboard.

Mixed Paper – Mixed paper refers to a mixture of the above three types of waste paper plus other waste papers such as junk mail, phone books, magazines, and non-corrugated cardboard such as cereal and pizza boxes (sometimes referred to as chipboard). Roofing material and boxboard manufacture are traditional uses of mixed paper, and for the production of low grade tissue and toweling products.



Glass – Although glass is found in a variety of forms and colors (e.g. clear, green and amber) in the municipal solid waste stream, container glass (i.e. bottles and jars) is the most commonly recyclable type of glass. The majority is generated in the residential sector. Waste container glass can be melted and mixed with virgin glass ingredients to make new container glass.

Steel and Bimetal Cans – There are two types of steel cans: tin-coated cans commonly known as “tin cans” and “bimetal” beverage cans. Bimetal cans have a coated steel body and aluminum ends. Bimetal beverage cans are easily mistaken for aluminum cans.



Aluminum Cans - Aluminum cans or used beverage cans (UBC) are among the most easily recoverable aluminum products. Aluminum cans are very readily reprocessed into new aluminum sheet. Other products containing aluminum, such as cookware, use a different type of aluminum and are not accepted at recycling centers since the different varieties are not readily substitutable. The cost savings

from using scrap aluminum rather than virgin inputs has provided for a strong scrap aluminum market.

Plastics – Plastic is a generic term that defines a wide variety of materials that are made up of one or more combination of plastic resins. The two most common, recyclable types of plastic are PET (Polyethylene terephthalate - #1) and HDPE (high density polyethylene - #2). PET (#1) is most commonly used to produce soft drink bottles. HDPE (#2) is most commonly used to produce milk and water containers, colored and opaque detergent bottles, and motor oil containers. Plastics labeled #3 - #7 currently have a minimal demand, so are not regularly collected; however, these items can be added to the list of recyclable products as demand increases.



Yard and Leaf Waste – Mandated municipalities are required to separate yard and leaf waste from other municipal wastes. Since September 26, 1990, no waste disposal facility accepts shipments comprised primarily of yard and leaf wastes unless a separate composting facility has been provided. Organic material can be ground to mulch, or processed to create compost, which has been proven to be beneficial in many agricultural applications, while removing a substantial waste stream from landfill disposal.



Other Recyclable Materials not specifically addressed by Act 101 – Large appliances or “white goods” can be shredded and steel separated for recycling. Some scrap dealers in the Region accept white goods. In addition many appliance stores will accept appliance trade-ins when selling a new appliance. In addition there are regional Recycling Events that include major appliances, computers and electronics, clothing and textiles, books and other items.

Electronics – Electronic equipment contains metals that, if not properly managed or contained, can become hazardous wastes. The "Covered Device Recycling Act" (House Bill 708), PA Act 108 of 2010 establishes a recycling program for certain covered devices; imposes duties on manufacturers and retailers of certain covered devices; provides for the powers and duties of the Department of Environmental Protection and for enforcement; establishes the Electronic Materials Recycling Account in the General Fund; and prescribes penalties for noncompliance.

Provided markets can be found, various other types of materials in the waste stream can be recycled. Tires, used motor oil, and automotive batteries are examples of recyclable items that pose disposal problems. Used tires can be retreaded, shredded and processed into crumb rubber for use in rubber plastic products, or they can be used to produce a durable ingredient in the production of asphalt. Alternatively tires can be shredded and burned as a source of fuel. The metal in automotive batteries and the polypropylene plastic case are recyclable. Used motor oil can be refined to produce heating fuel, industrial lubricants and even new motor oil. Used textiles can also be recycled. Textiles can be reused as rags, or reprocessed into filler products such as insulation or furniture padding. Non-treated wood can be

recycled into playground mulch and used as a fuel sources. Good sources for identification of locations to drop off these “hard-to-recycle” materials is included in the Appendices (Links to Websites of Interest).

C. Typical Composition of Landfilled Recyclable Materials

According to the Municipal Solid Waste Characterization Study conducted by R. W. Beck for the PADEP, there were over 2 million tons of recyclable materials landfilled in 2001. This material included paper, plastic, glass, metal, organics, and inorganics. The following page contains a table from the R. W. Beck study (“Table 1: Statewide Aggregate Landfilled Municipal Solid Waste Composition Detail”), which lists the type of each material and the tons disposed in 2001. Copies of the complete study can be obtained from the PADEP web site at the following website location:

http://www.dep.state.pa.us/dep/deputate/airwaste/wm/RECYCLE/Waste_Comp/Study.htm.

This information shows that there is still considerable room for improvement in recycling. For counties and municipalities to increase their recycling, they need to investigate expanding the types of materials collected curbside or drop-off, select material commodities that are more cost-effective to collect, expand the number and hours of drop-off programs, intensify public outreach efforts (particularly through schools), and focus on recycling in commercial, institutional, and multi-family facilities. They also need to continue to increase the number of special collections, and composting opportunities.

Table 1
Statewide Aggregate Landfilled MSW Composition Detail (Weight Percent)

	Material Categories	Tons Disposed	Mean Composition	Standard Deviation	Confidence Interval		Sampling Error
					Lower (%)	Upper (%)	
Paper		3,117,182	33.3%	20.0%	31.7%	34.9%	4.9%
	1 Newspaper	389,263	4.2%	4.4%	3.9%	4.5%	8.2%
	2 Corrugated Cardboard	785,032	8.4%	10.7%	7.7%	9.3%	9.2%
	3 Office	341,975	3.7%	5.7%	3.3%	4.2%	13.0%
	4 Magazine/ Glossy	251,027	2.7%	4.1%	2.4%	3.1%	14.4%
	5 Polycoated/Aseptic Containers	49,074	0.5%	1.2%	0.5%	0.6%	13.3%
	6 Mixed Paper	433,821	4.6%	5.0%	4.3%	5.1%	7.8%
7 Non-recyclable Paper	866,990	9.3%	7.5%	8.7%	10.0%	6.7%	
Plastic		1,062,336	11.3%	9.2%	10.7%	12.1%	6.3%
	8 #1 PET Bottles	87,601	0.9%	1.4%	0.9%	1.0%	9.7%
	9 #2 HDPE Bottles	68,082	0.7%	0.8%	0.7%	0.8%	8.0%
	10 #3-#7 Bottles	16,871	0.2%	0.4%	0.2%	0.2%	16.2%
	11 Expanded Polystyrene	71,088	0.8%	1.5%	0.7%	0.9%	12.5%
	12 Film Plastic	465,586	5.0%	4.8%	4.7%	5.4%	7.1%
13 Other Rigid Plastic	353,108	3.8%	5.1%	3.4%	4.2%	10.8%	
Glass		282,316	3.0%	5.3%	2.7%	3.4%	10.3%
	14 Clear Glass	129,923	1.4%	2.0%	1.3%	1.5%	10.0%
	15 Green Glass	38,468	0.4%	1.1%	0.4%	0.5%	18.6%
	16 Amber Glass	66,238	0.7%	1.9%	0.6%	0.9%	23.6%
17 Non-recyclable Glass	47,688	0.5%	2.1%	0.4%	0.6%	15.8%	
Metals		508,702	5.4%	8.6%	5.1%	5.9%	7.3%
	18 Steel Cans	102,532	1.1%	1.3%	1.0%	1.2%	8.1%
	19 Aluminum Cans	48,844	0.5%	1.1%	0.5%	0.6%	12.7%
	20 Other Ferrous	282,131	3.0%	8.0%	2.7%	3.4%	12.1%
	21 Other Aluminum	43,057	0.5%	1.2%	0.4%	0.5%	10.4%
22 Other Non-Ferrous	32,138	0.3%	1.4%	0.3%	0.4%	15.9%	
Organics		3,204,208	34.2%	21.7%	32.8%	35.7%	4.2%
	23 Yard Waste- Grass	136,084	1.5%	3.9%	1.2%	1.8%	21.7%
	24 Yard Waste- Other	347,164	3.7%	8.2%	3.1%	4.6%	19.4%
	25 Wood- Unpainted	540,611	5.8%	15.8%	5.2%	6.7%	12.9%
	26 Wood- Painted	234,406	2.5%	8.6%	2.3%	2.9%	12.6%
	27 Food Waste	1,127,170	12.0%	11.8%	11.3%	13.1%	7.7%
	28 Textiles	352,570	3.8%	6.8%	3.5%	4.2%	9.8%
	29 Diapers	217,875	2.3%	4.1%	2.1%	2.6%	10.5%
	30 Fines	92,451	1.0%	1.3%	0.9%	1.1%	8.4%
	31 Other Organics	155,877	1.7%	4.1%	1.5%	1.9%	12.7%
Inorganics		1,194,338	12.7%	23.2%	11.8%	13.9%	8.3%
	32 Electronics	137,299	1.5%	4.3%	1.3%	1.8%	16.4%
	33 Carpet	163,371	1.7%	6.2%	1.5%	2.1%	17.4%
	34 Drywall	99,009	1.1%	6.1%	0.9%	1.3%	15.7%
	35 Other C&D	446,516	4.8%	16.0%	4.2%	5.5%	13.7%
	36 HHW	28,203	0.3%	1.2%	0.3%	0.4%	13.6%
	37 Other Inorganics	207,682	2.2%	5.9%	2.0%	2.6%	14.2%
38 Furniture	112,258	1.2%	6.8%	1.0%	1.6%	25.5%	
	Total	9,369,083	100.0%				

D. Processing/ Disposal Alternatives

The following section briefly highlights waste processing and disposal system alternatives that are currently available in the industry. This section also focuses on alternatives that have specific compatibility or that show particular promise within the current Columbia, Lycoming, Montour, Snyder, and Union Counties' waste management system that was described earlier in this chapter.

Landfill

Development of a New Sanitary Landfill



Sanitary landfilling is an engineered method of disposing of solid waste on land. State and federal environmental regulations and advances in design technologies have combined to minimize the impact of sanitary landfills on the surrounding environment. The PADEP Municipal Waste Regulations require all new and existing (operating) landfills to be designed with a double liner system with leachate collection and detection elements. In addition, after closure of the landfill, the disposal area is required to be capped with a low permeability liner system to restrict the downward flow of precipitation into the waste material.

A landfill can accept a broad variety of materials including sewage sludge, construction and demolition waste, and incinerator ash, as well as municipal and residual wastes. These materials, as well as bulky items such as furniture, building materials, and large appliances that do not contain Freon, can be readily disposed of, but may pose operational difficulties. Further, special permit modifications are required for the disposal of sewage sludge and incinerator ash. For these reasons, not all landfills accept all of these materials.

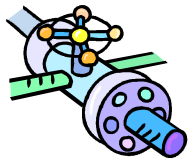
The chief environmental concerns associated with landfilling waste are leachate contamination of groundwater, the danger of explosions caused by migrating methane gas, atmospheric and environmental health hazards from landfill gases, truck traffic, odor, litter, and the aesthetic "eyesore" of the landfill site in general. Applications for new landfill permits in Pennsylvania must demonstrate that the benefits of the project clearly outweigh the "harms" or negative impacts. Development of a new sanitary landfill is also capital-intensive, with high permitting, land, and site development costs.

Expansion of an Existing Landfill

An alternative to developing a new landfill is to expand an existing landfill. There are two main ways to expand an existing landfill. The first method is to enlarge the existing landfill's footprint, or in other words, to expand horizontally. This can be done by developing new cells adjacent to the existing landfill cells, or by developing new cells on a remaining portion of the existing landfill property. Some landfills are limited by their existing footprint, and do not have the capability of expanding horizontally. These landfills may expand using the second method of vertical expansion, employing

the use of a mechanically stabilized earth (MSE) berm around the perimeter of the existing footprint. An MSE berm allows the expansion to occur while the operation is still accepting waste, so as not to interrupt waste flow to the landfill. A vertical expansion with an MSE berm allows a landfill to modify its geometry, to allow an increase in capacity, without substantial liner footprint increase or setback conflicts.

Landfill Gas Recovery



Landfill gas (LFG) is the natural by-product of the decomposition of solid waste in landfills and is composed primarily of carbon dioxide and methane. As part of federal regulations, landfill gas is required to be monitored and collected. The most common options for managing landfill gas are flaring, use of landfill gas as energy, direct use of landfill gas for electricity generation and use of cleaned landfill gas in a pipeline to customers and/or natural gas lines. Using LFG helps to reduce odors and other hazards associated with LFG emissions, and helps businesses, states, energy providers, and communities protect the environment and build a sustainable future.

Flaring

A gas flare, alternatively known as a flare stack, is an elevated vertical thermal combustor. They are used to eliminate waste gas when gas extraction rates do not sustain direct use or electricity generation. Flares can be either open or enclosed. Enclosed flares are typically more expensive, but maintain high combustion temperatures and specific residence times as well as limit noise and light pollution. Some US states require the use of enclosed flares over open flares, including PA. Venting of landfill gas is a significant source of greenhouse gas emissions which is why the US EPA regulates the emissions of landfill gas. Recently, under the Kyoto Protocol, garbage collecting companies in some developing nations have received a carbon bonus for installing combustion devices for the methane gas produced at their landfills, preventing methane from reaching the atmosphere. After the burning, this gas is converted to heat, water and CO₂. Flares are beneficial in all landfill gas systems as they can help control excess gas extraction spikes and emissions during maintenance down times.

Landfill Gas to Energy

Landfill gas is treated to remove impurities, condensate, and particulates. The treatment system depends on the end use. Minimal treatment is needed for the direct use of gas in boilers, furnaces, or kilns. Using the gas in electricity generation now requires more in depth treatment due to the requirements of the newer combustion equipment. Treatment systems are divided into primary and secondary treatment processing. Primary processing systems remove moisture and particulates. Secondary treatment systems employ multiple cleanup processes, physical and chemical, depending on the specifications of the end use. Two constituents that may need to be removed are siloxanes and sulfur compounds which are damaging to engine and turbine equipment and significantly increase maintenance cost.

Historically, landfill gas has been converted at on-site locations using dedicated internal combustion engines. These projects used to be relatively simple to permit and demonstrated favorable economics by requiring minimal infrastructure to support the end product. However, in recent years, air permits for internal combustion engines have become more difficult to obtain, and in the future appear to require gas treatment prior to the engine. The alternative for larger projects is the employment of gas turbines. Microturbines are used for small gas flow conditions.

Internal Combustion Engine

More than 70 percent of all landfill electricity projects use internal combustion (IC) engines because of relatively low cost, high efficiency, and good size match with most landfills. IC engines have relatively high maintenance costs and air emissions when compared to gas turbines. IC projects have a large amount of thermal energy which is most commonly exhausted to the atmosphere as waste heat.

Gas Turbine

Gas turbines usually meet an efficiency of 20 to 28 percent at full load using landfill gas. Efficiencies drop when the turbine is operating at partial load. Gas turbines have relatively low maintenance costs and nitrogen oxide emissions when compared to IC engines. Gas turbines require high gas compression, which uses more electricity to compress, therefore reducing the overall efficiency. Gas turbines are also more resistant to corrosive damage than IC engines.

Microturbine

Microturbines can produce electricity with lower amounts of landfill gas than gas turbines or IC engines. Microturbines can operate between 20 and 200 cfm and emit fewer nitrogen oxides than IC engines. Also, they can function with less methane content (as little as 35 percent). Microturbines may require extensive gas treatment and come in sizes of 30, 70, and 250 kW.

Landfill Gas To Direct Use

Landfill gas can be treated at the landfill, compressed and conveyed in a pipeline for direct use in equipment located some distance from the landfill. Aside from the economics of constructing a pipeline, these projects offer benefits in air permitting since the off-site facility already maintains permits and the heating value of the landfill gas can be sold as a renewable fuel offsetting fossil fuel at the off-site location. These projects tend to have higher development costs compared to electric only but are offset by more predictable permitting outcomes, better environmental value to the community, and provide long-term attachment of the landfill gas end user to the community.

Pipelines transmit landfill gas to boilers, dryers, or kilns, where it is used much in the same way as natural gas. The use of landfill gas in a project has economics that establish

the landfill gas as the cheaper energy compared to the alternative natural gas or oil. Boilers, dryers, and kilns are used often because they maximize utilization of the gas, limited treatment of the gas is required, and the gas can be combined with other fuels. Boilers use the gas to transform water into steam for use in various applications, i.e. heating of existing structures at the landfill site or nearby businesses and homes. Disadvantages of boilers, dryers, and kilns are that they need to be retrofitted in order to accept the gas and the end user has to be nearby for favorable project economics as pipelines are required to convey the landfill to the fuel consumer. Early projects limited pipeline lengths to 3 to 5 miles, but recent projects have constructed pipelines for distances over 10 miles with a once planned PA project to be 22 miles.

Landfill Gas to Pipeline Quality

Landfill gas contains about half the heating value of natural gas. Landfill gas can be converted to high-Btu gas by reducing its carbon dioxide, nitrogen, and oxygen content. The high-Btu gas can then be piped into existing natural gas pipelines or used in the form of CNG (compressed natural gas) or LNG (liquid natural gas). CNG and LNG can be used on site to power hauling trucks, equipment using natural gas, or sold commercially offsetting natural gas.

The conversion of landfill gas into a high BTU gas was considered experimental a few years ago. However, the difficulty in attaining air permits for on site facilities to generate electricity have quickly advanced the prototype equipment into working production facilities. Some of the best working examples of these conversion technologies are currently found on the west coast of the US.

Combustion (Waste-to-Energy)

In a typical waste-to-energy combustion facility, waste is unloaded into a receiving pit. An overhead crane feeds waste into the furnace hopper. The crane operator may pick out oversize items, such as large appliances, and will mix the waste to obtain homogeneous fuel supply. Within the combustion chamber, the burning waste is transported along the moving grates of the stoker assembly or similar grate system. Heavy ash, called bottom ash, falls off the end grate and is cooled with water. The hot combustion gases pass through the combustion chamber and pass across boiler tubes to produce steam. Also, the walls of the furnace itself are typically fitted with a network of water-filled tubes that use the heat to produce steam. The steam is often passed through a turbine to produce electricity. The produced steam may also be distributed to nearby establishments for heating and/or for use as a process steam.

A combustion incinerator can process approximately 98 percent, by weight, of the municipal solid waste stream. The quantity of ash residue requiring disposal will equal approximately 20-30 percent, by weight (by volume, approximately 10 percent) of the processed waste stream. The non-processibles (materials removed prior to combustion) and the unburned ash residues are usually handled through combination of recycling and landfilling. The non-processibles and especially the ash residue involve special

disposal considerations that impact their disposal costs. Lower disposal costs, when compared to MSW, can be achieved if the ash is classified as an alternative daily cover (ADC).

Federal and State regulations require that landfills cover their solid waste daily with a minimum of six (6) inches of dirt. The daily cover is intended to minimize disease vectors and animal attraction, control leachate and erosion, reduce fire hazard potential, minimize wind-blown litter, reduce noxious odors, provide an aesthetic appearance and allow accessibility regardless of weather. Alternative daily cover was created to reduce the costs of placing six (6) inches or more of dirt each day on the landfill and/or decrease the amount of air space consumed by the six inches of daily cover. Alternative daily cover includes a wide variety of materials including, but not limited to foam, tarps, recycled tire chips, finely crushed glass, ash, etc. The type of alternative daily cover used at each landfill is dependent upon many considerations. Some of these considerations are regulatory, environmental, economic, longevity, and public perception.

The chief environmental concerns of waste combustion are air emissions of acid gases, heavy metals (e.g., lead, mercury), and certain organic compounds, and contamination of air and water through improper handling and disposal of the ash residue.

State and federal emissions control requirements, which currently mandate that new facilities install scrubbers for acid gas control and electrostatic precipitators (ESPs) or fabric filters (baghouses) for particulate removal, are aimed at minimizing the risk of harmful health effects from solid waste incineration. Current technology and air regulations allow MSW combustion to have less air emissions than an equivalent coal-fired power plant.

In general, waste-to-energy projects are very capital-intensive due to extensive equipment and building needs. Larger waste-to-energy facilities are generally constructed in similar fashion to power utility plants with field-erected combustion and boiler systems. These can be economically feasible at sizes as low as 300 tons per day (tpd). Below 300 tpd, most waste-to-energy facilities are constructed with pre-fabricated, modular furnaces. Such modular systems have a lower capital cost. Recent high oil prices have generated a renewed interest in MSW combustion.

Refuse-Derived Fuel (RDF)

At an RDF facility, mixed waste is processed mechanically (and perhaps manually) into a form rendering it more suitable for use as a fuel. Typical processing steps involve size reduction, removal of noncombustible materials, mixing/blending and either shredding or densification into pellets or briquettes.

The RDF product can be marketed to institutional or industrial facilities for use as a supplemental fuel in their existing boilers. Additional air pollution control measures may be required depending upon the specific application. If insufficient markets exist,

the RDF can be burned at the RDF facility in a dedicated boiler. In Pennsylvania, PADEP requires a facility that burns RDF fuel to obtain a waste management permit much the same way as a waste-to-energy facility does. This negatively impacts the prospects for developing an RDF project.

The fuel preparation process produces residuals requiring disposal; the quantity depends on the composition of the input waste on the processing system. The process typically removes ferrous metal for recycling, and may separate other materials for recycling. If a dedicated boiler is used, there will be ash requiring disposal.

The potential environmental impacts of an RDF facility are similar to those of a waste-to-energy facility. There are additional concerns of worker health and safety due to the potential for explosions in the shredder and exposure to airborne material such as bacteria and molds. RDF projects are very equipment and capital-intensive. Finding a long-term user for the refuse-derived fuel material is critical to the financial feasibility of an RDF project.

Biogasification

Biogasification involves the conversion of the organic fraction of municipal solid waste into methane gas by the activities of anaerobic bacteria in an enclosed digester. The methane gas can be used as a fuel for steam production, for subsequent sale to nearby utilities or industries, or it can be cleaned and sold as a stand-alone fuel.

The biogasification technology has been traditionally used to process highly liquid, easily biodegradable wastes such as animal manure and organic sludge. To use this technology to process municipal solid waste, extensive preprocessing of the waste must be done to separate out the organic fraction and process it into small, uniform particle sizes which are essential for proper anaerobic digestion. The temperature, carbon-nitrogen ratio, and pH of the waste mixture must be carefully monitored and controlled to achieve proper digestion of the waste. A by-product of the decomposition process is a solid residue (i.e., waste which has not been converted to methane gas) which must either be disposed of elsewhere, or further processed for use as fuel or compost.

The application of the biogasification technology has received a recent resurgence in interest as a renewable energy source due to the high cost of oil. Projects being developed usually involve the use of a clean organic feedstock, and this technology is still in the developmental stages.

The potential environmental impacts of a biogasification facility are those of operating a shear shredder and odors. There are additional concerns of worker health and safety due to the potential exposure to airborne material such as bacteria and molds. Biogasification projects are very equipment and capital-intensive. Finding a long-term user for the fuel is critical to the financial feasibility of a biogasification project.

One example of biogasification technology that has been employed recently in other parts of the world is ArroBio.

ArrowBio

The ArrowBio process is an integrated solution that receives MSW pre-sorted or unsorted, which eliminates the need for prior separation or classification of mixed waste. The waste is delivered and dumped into a pit, where bulky items will be removed and the waste bags will be opened. The preliminary dry waste preparation and separation stage is based on the concept that most of the biodegradable organic materials are smaller and can subsequently be separated with the waste's liquids by a trommel. The larger particles, such as cardboard, paper and plastics will go through and can be separated manually. The preliminary liquid-based waste preparation and separation stage is based on the concept that inorganic materials, such as metals and glass, weigh more than water, while plastics and biodegradable organic matter have a weight that is equal to or less than water. The larger materials will enter the primary vat, while the smaller materials will go to the secondary vat.

The heavy components that dropped to the bottom and were subsequently separated from the organic stream include ferrous metals, non-ferrous metals, glass and other static materials. These materials travel down a processing line, where they are separated by a number of methods, including a magnetic force, an eddy current and manual means. The remaining materials are returned to the dissolving tank and proceed to the light materials process.

The light organic waste, already separated from the heavy components, is transported through a conveyor into a trommel, where strong water streams wash the materials and they enter a rough screen where the smaller elements go through the holes to a hydro-crushing unit. The large items proceed to a sorting conveyor, where the PET and HDPE materials are screened out manually. The metals are removed by a magnet, and the film plastic is blown out by using an air sifter. The rest of the materials enter into a rough shredder and then to the hydro-crusher.

The biodegradable material enters the filtering system. The residual contaminations are filtered out, and the grit, sand, broken glass, and small metal elements are screened out using a settling vat. Larger elements go through a secondary air sifter and then return for a second cycle in the system, or are dropped out of the process and sent to a landfill. The remaining energy rich organic watery solution is sent to the biological reactors to yield fertilizer, water and biogas.

In the biological reactors section the fluid undergoes two more processes, both of which are coordinated by naturally occurring microorganisms. In the first bioreactor tank, acidogenic fermentation transforms complex organic material into simpler organic acids and fatty acids. This acid rich organic matter is then heated and transported to the Methanogenic Fermentation reactor for anaerobic degradation of the organic materials and the generation of clean fertilizer, water and biogas. The biogas can be used for

energy needs and for heating the Methanogenic tank. The anaerobic digestion process generates fertilizer, water and biogas containing up to 75% methane. The biogas can be sold as clean green energy for transportation and power plants.

There are plants in Hiriya, Israel and Sydney, Australia that are currently utilizing the ArrowBio process.

Composting/Co-Composting

Composting is a biological oxidation process that breaks down the biodegradable organic material in waste into simpler, more stable compounds, carbon dioxide, moisture and heat. The compost end-product is humus containing nutrients and minerals that can be used as a soil supplement. Although of lesser nutrient value than fertilizer, the compost improves soil structure for root development, increases water retention in sandy soils, improves drainage in clayey soils and adds to the cation exchange capacity of soils. A quality compost product appears much like peat and has similar uses. A typical municipal refuse composting operation consists of the following four basic steps:

- Pre-processing – Initial processing consists of sorting, shredding, and preparation of a feedstock mixture suitable for composting. Some of the recyclable materials in the waste, such as ferrous and non-ferrous metals and glass, may be removed at this stage. The mixture of biodegradable materials, or feedstock, is adjusted to optimum moisture and nutrient levels, and particle size of the materials may be reduced. A “dirty MRF” type of pre-processing line is sometimes used to prepare a wastestream for composting.
- Municipal waste is sometimes co-composted with wastewater biosolids (sewage sludge). This mixture of two waste streams provides nutrients and moisture from the biosolids that are needed for the proper composting of the high-carbon municipal solid waste. Water can be added to the mix to attain optimal moisture levels. The solid waste acts as a bulking agent for the composting of the biosolids.
- Biological and chemical decomposition - This composting stage makes use of naturally occurring bacteria and other microorganisms to break down the organic portion of the waste, in the presence of oxygen, into stable by-products.
- Curing - Curing is required to stabilize the compost mix and to assure that the biochemical breakdown process is complete. Curing helps assure that the compost product will not contain toxic compounds when used as a growing medium. After a 1-2 month curing phase, the material is usually considered stabilized.
- Product Screening - The compost product is prepared for use through screening, removal of contaminants (such as glass), packaging (if needed), and marketing.

Solid waste composting stabilizes only the organic fraction of the waste stream. Contaminants such as glass, plastic, metal, rubber, and textiles should be screened out, depending upon the final uses and market specifications, and either recycled or landfilled as appropriate. Compost-laden recyclables typically carry a lower sales value than curbside-collected, clean recyclables.

A composting facility can divert and reclaim approximately 60-70 percent of the municipal solid waste stream from disposal through landfilling. The quality of the final product benefits from the presorting/ removal of glass, household hazardous waste,

household batteries and used motor oil. Building corrosion, odor control, and fire suppression needs at mixed waste composting sites, as well as the quality of the final product, are critical issues that need to be addressed for proper development of a composting project. The residue sent to the landfill after separation from the compost feedstock is largely inorganic in nature, and most of the soluble components of the waste stream have been removed.

There is a strong industry push to develop segregated organics composting facilities throughout the US, and low-technology yard waste composting facilities are commonly used by municipalities and counties throughout the northeast US to divert a significant fraction of the municipal wastestream to a beneficial use, at a relatively low cost (Pennsylvania currently has nearly 500 of them). Exhibit 4 contains the locations of the compost facilities that are known to exist within the five-County Region.

One example of a low technology composting facility that is currently operating in the Region, and that has recently included food waste as part of its feedstock, is the Briar Patch Organic Farm in Union County.

Briar Patch Organic Farm/Weis Markets Composting Initiative



This small, private windrow-technology composting facility has been in operation for nearly 20 years. In 1994, Union County received a PADEP 902 grant to purchase the following yard waste processing equipment:

- Tractor-drawn windrow turner;
- Tractor; and
- Bobcat.

An agreement was made between Union County and Mr. Preston Boop, owner of Briar Patch Organic Farm (located in Union County), for Mr. Boop to process the County's yard wastes at his site with the equipment purchased through the grant. The yard waste from the Borough of Lewisburg is delivered for processing approximately twice per year. Additionally, the general public is allowed to drop off their yard waste at the site. The organic farm currently uses yard trimmings from the Borough of Lewisburg, vegetative materials, manure, and animal mortalities generated on-farm to make compost. Workers process this material in windrows and sell the finished compost or soil amendments or apply it on-site to grow certified organic feed for dairy farmers.

In 2010, Briar Patch Organic Farm began a 3-month pilot program to accept and process food waste from a Weis Markets (headquartered in Sunbury) grocery store in the region. The grocery store source-separated food residuals and delivered them to the compost site. Twelve tons per week of organic food waste was delivered to Briar Patch Farm, mixed into windrows, and composted. The pilot program ended in March 2010.

In September 2010, Weis Markets began a second pilot project with composter Two Particular Acres (Royersford PA) and aggregate producer H&K Group. The H&K group has more than 40 operating quarries, a fleet of more than 700 trucks and other necessary equipment and real estate to partner with Two Particular Acres and offer instant infrastructure, and the regional capacity to handle the incoming organic feedstocks. The H&K Group, Two Particular Acres and Weis Markets have partnered to form American Biosoils and Compost. The newly formed company submitted to PADEP a new modified General Permit 30 that will allow anyone who already has a composting permit, to take in as much food waste as they can handle on their site as long as they take in twice the amount of yard debris. Additionally, the company made an application under a new general permit with permit provisions and conditions, to possibly move forward until the modified General Permit 30 is issued. Two Particular Acres is currently acting as the test site with the four-store initial pilot project. American Biosoils and Compost will open up four more sites in Pennsylvania, once a permit is in place, with an additional 20 sites not far behind. Currently, Ned Foley of Two Particular Acres collects the food waste from the Weis Markets stores participating in the program. Black 96-gallon totes labeled "COMPOSTABLES ONLY" are stored in walk-in coolers at the Weis Markets sites to keep their organic contents stable. The Weis stores have been averaging 1 ton of organic material a week. Weis Markets hopes to use the compost for customers (supplying the material for sale in their stores), as well as use in wetland mitigation, landscaping mulch or as soil amendment on new construction projects.

Wal-Mart in NorthCentral PA

The Wal-Mart Corporation has established goals, companywide, to become more environmentally sustainable and reduce the amount of waste generated in their facilities through source reduction and reuse, composting and recycling. With this in mind, several Wal-Marts in NorthCentral PA have contracted with Organix for the collection of compostable materials. Wal-Mart collects compostable material, i.e. old produce that is not sellable and old coffee grounds, in compost bins on site. Organix picks these bins up once or twice per week and takes the compostable materials to the Reinford Dairy Farm in Mifflintown, PA. At the Reinford Dairy Farm, the material is placed in a digester and eventually converted into electricity that is used on the farm.

Emerging Waste Conversion Technologies

Pyrolysis

Pyrolysis involves the heating of waste without sufficient oxygen for combustion, causing its decomposition into combustible gases, liquids, and a solid residue (char) which resembles coal. This technology was traditionally used to produce methanol, acetic acids, and turpentine from wood. The most promising aspects of its application to municipal solid waste are low air emissions and the flexibility to produce a broad range

of energy forms, which would enable the facility to respond to changes in local energy demands.

The pyrolysis technology has not been commercially developed in the United States for application to the municipal solid waste stream. An attempt to develop a large-scale pyrolysis project to process municipal waste was attempted unsuccessfully by Monsanto for the City of Baltimore in the 1970's. Thus, it is still considered to be an experimental waste processing technology. Obstacles which have hindered the commercialization of pyrolysis as a municipal solid waste processing technology include: the interference of inorganic materials with the pyrolysis process; inconsistencies in the quality of the liquid and char end products of pyrolysis; the low combustion value of the char end product; and the lack of energy markets for end-products.

Pyrolysis/Gasification

This technology is a variation of the pyrolysis process. Another reactor is added to this system whereby any carbon char or pyrolysis liquids produced from the initial pyrolysis step are further gasified, which may use air, oxygen, and/or steam for these gasification reactions. Pyrolysis/ gasification reactors operate predominantly in an oxygen-starved environment, since the combustion reactions quickly consume the oxygen, producing heat sufficient for the pyrolysis reactions, resulting in a raw synthesis gas (syngas) exiting the reactor. The raw syngas is cleaned up of particulate matter from the reactor, which can include sulfur, chlorides/acid gases, and trace metals such as mercury. Syngas is used in a power generation plant to produce energy, such as steam and electricity, for use in the process, and the excess generation is exported as energy. The exported energy is typically converted into electricity and supplied/ sold to the grid.

The end products from the energy generation in the reactor are typically ash, slag, and metals. The metals can be recycled; however, the ash and/or slag require disposal in a landfill.

As of 2009, there were seven facilities utilizing this technology in Japan, with a new facility in development in Puerto Rico. Six of these facilities were using MSW as their source of waste. Of these six facilities in Japan, four were generating power from their operation. The six operations in Japan are using the syngas in gas engines or boiler systems.

Plasma Arc Gasification

This type of facility uses a reactor with a plasma torch, and involves processing organics of waste solids. This method involves a high temperature pyrolysis process where the organics of waste solids are converted into syngas, while the inorganic materials and minerals of the waste solids produce a rock-like, glassy by-product called vitrified slag, mainly comprised of metals and silica glass. The syngas is predominantly CO and H₂. The high temperature needed to complete the process is created by an electric arc in a torch where gas is converted into plasma. In commercial practice, the plasma arc gasification process is operated with an injection of a carbonaceous material like coal or coke into the plasma arc gasification reactor. This material reacts quickly with oxygen to

produce heat for the pyrolysis reactions. The metals of the vitrified slag can be recovered and recycled, while the slag can be used to make other products such as rock wool, floor tiles, roof tiles, insulation, and landscaping blocks. Vitrified slag is environmentally acceptable as a recyclable by-product, which is a benefit of this method of waste conversion technology. An additional benefit of this method is that developments in design of plasma arc gasification reactors have improved and lessened the need for pretreatment/ preprocessing.

As of 2009, there were three plasma-arc plants in operation in Japan. The total tons accepted at each plant ranged from 25 tons per day to 165 tons per day. Plasma arc gasification has also been used for MSW ash in Chiba City, Imizu (12 tons per day), Kakagawa (30 tons per day), Kinura and Shimonoseki (41 tons per day).

Of the above mentioned energy recovery technologies, including waste-to-energy, plasma arc gasification is the most thermal and economically efficient method. In addition to generating the highest net annual revenue of the above mentioned technologies, including waste-to-energy, it should be noted that the vitrified slag byproduct can be used as road material, which then adds an additional revenue source for this process method.

E. Recyclables collection by Subscription in mandated communities

There have been many conversations with PADEP to discuss the exact requirements of Act 101 as it pertains to recyclables collection in mandated communities. The five-County Region has expressed interest in qualifying a subscription collection method for refuse and recycling in both mandated and non-mandated municipalities. The counties want to find ways to provide and increase recycling services to their residents, but funding for recycling programs is lacking. The following information was provided to the counties from PADEP in response to the inquiry about developing a private subscription-based recyclables collection program in place of a municipality-wide curbside collection program in mandated communities. PADEP's response to this inquiry is as follows:

“As set forth in Section 1501(e) of Act 101 and Section 272.424 of the regulations, a private subscription, multiple recycling hauler system is allowed under Act 101. The Department does have concerns regarding private waste haulers doing the recycling for their customers in mandated municipalities. Please note that there would be less concern regarding having a private hauler system in a non-mandated municipality because the municipality does not need to meet Chapter 15 of Act 101.

- 1. Recycling service is to be provided to all residents. Section 1501(c) (1)(i) of Act 101 says that mandated municipalities are to adopt an ordinance that requires recycling of at least 3 materials by residents. The recycling program is required, not optional, meaning that all residents must be provided with recycling service, and there cannot be a way for residents to "opt out" of the recycling program. The Department views this as meaning that all residents need to have the service available to them. (Whether or not they actually utilize the recycling service is an issue of ordinance enforcement).*

2. *All haulers collect the recycling in a municipality on the same day. Section 1501(c)(2) says that recycling collection is to occur on a scheduled day at least once per month.*
3. *All haulers should be collecting the same materials per Section 1501(c)(1)(i) of Act 101 and the local ordinance. The statute says that consistency in the program and residential recycling education is necessary, and the municipality is to explain how the recycling system will operate and the dates of collection per Section 1501(c) (3) of Act 101. The municipality chooses the (minimum) 3 materials for recycling.*
4. *Residential participation in the curbside recycling program should be monitored*
5. *Municipalities should revise their recycling ordinances if the new private hauler recycling program were to be implemented.*
6. *Enforcement of recycling program: to ensure the materials collected are getting recycled by the haulers, weights are being reported, residents are participating, etc., Section 1501 (c)(4) of Act 101 requires that the municipality establish provisions to ensure compliance with the recycling ordinance. As set forth in Section 304(f) of Act 101, the municipality is to report its recycling weights to its county by February 15th of each year.*
7. *Grant-funded equipment use: Lycoming County currently has two curbside recycling trucks for residential recycling. These trucks were purchased with grants as set forth in Section 902 of Act 101, for recycling use. If the County no longer does curbside pick-up and no longer needs to use these trucks for recycling, then the Department would anticipate that the County would be in touch with the Department with regard to what steps would be taken with the equipment (i.e., selling the equipment and returning money to the State, or transferring the equipment to another municipality or county, etc).*
8. *If any of the waste haulers do not have the ability to collect recycling: what would happen to their customers?*
9. *Existing curbside contracts: How would existing curbside collection contracts with any municipalities be impacted with such a change by the County?*
10. *Loss of materials to the LCRMS MRF: If private haulers take the recycling they collect anywhere they choose—could this ultimately negatively impact the tonnage received by LCRMS?*
11. *Failure to implement a private hauler-based recycling program in a mandated municipality that complies with the requirements of 1501 (as listed above) could result in the municipality being ordered by DEP to utilize another system (i.e. contracted or municipal collection).”*

Much of PADEP’s cautionary approach to this concept is because it has seen such a system not work properly in this region already. It is expected that PADEP would

scrutinize the setup and implementation of such a system closely, to insure that Act 101 requirements are being fully complied with.

EPA – Land, Waste, and Cleanup Topics

[Land, Waste, and Cleanup Topics | US EPA](#)

EPA – Landfill Information

[Landfills | US EPA](#)

EPA – Environmental Benefits of Recycling

<https://www.epa.gov/recycle/recycling-united-states>

EPA – Facts and Figures about Materials, Waste and Recycling

<https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling>

EPA – National Overview: Facts and Figures on Materials, Wastes and Recycling

<https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials>

Act 101 Program Review

Executive Summary

Statewide recycling in Pennsylvania began in 1988 with a state law — the Municipal Waste Planning, Recycling and Waste Reduction Act, or Act 101 — that required larger municipalities and encouraged smaller municipalities to recycle. Act 101 authorized each county to develop a plan to manage its wastes. Each year, the counties report recycling data to the Pennsylvania Department of Environmental Protection (Department or DEP), which consolidates the reports to develop a statewide profile. To fund these programs, the act imposed a \$2-per-ton recycling fee on waste disposed at Pennsylvania municipal waste landfills and waste-to-energy facilities. To date, the fee has not changed. The Recycling Fund has generated approximately \$39 million annually since its inception and Pennsylvania counties have reported recycling more than 132 million tons of materials.

However, in the last two decades there has been approximately \$188 million diverted to other programs including Waste Tire Remediation, Growing Greener, Forest Lands Beautification and General Fund augmentations. The most recent diversion of \$50 million to the General Fund has greatly impeded DEP's ability to implement new plans and new ideas. Stated simply, most of the recommendations in this report cannot be accomplished since adequate resources no longer exist.

Despite this reappropriation, at least 89% of Pennsylvania's population (11.25 million out of a total population of more than 12.7 million) has access to recycling through the Commonwealth's 1,114 municipal curbside collection programs and 775 county and municipal drop-off programs. About 57% of Pennsylvania municipalities have curbside pick-up and/or access to drop-off programs. From 2015 through 2019, DEP awarded approximately 3,700 grants totaling over \$164 million to counties and municipalities to develop and expand local recycling, planning and other waste management programs, for an aggregate of over 24,000 grants totaling over \$887 million since 1988. Public education and market development have also received significant funding over the years. Over the last five years, DEP has invested approximately \$4.2 million in the Commonwealth's Recycling Markets Center.

Over calendar years 2015 - 2019, Pennsylvania's municipal waste landfills and waste-to-energy facilities reportedly received approximately 113 million tons of waste; of this total, approximately 74 million tons of waste were generated in Pennsylvania and approximately 39 million tons were imported. It is estimated that approximately 1.5 million tons were exported to bordering states. This illustrates that there is still work to be done in waste reduction and recycling.

Recycling has tremendous positive impact on the environment and the financial health of Pennsylvania. Because of recycling, nearly 10 million metric tons of carbon dioxide emissions are avoided per year. This is equivalent to removing 2.15 million (or just over 25%) of Pennsylvania's vehicles from the road annually.

Pennsylvania counties reported recycling over 27 million tons from 2015-2018. The 5.5 million tons of material Pennsylvanians recycled in 2018 is enough to fill 212 capitol domes!

There is a cost for collection, transportation and processing for both recycling and disposal. This has been a point of confusion, as many Pennsylvanians are under the false assumption that recycling is free. The significant difference occurs at the end of the cycle when waste is disposed,

whereas recyclables are reintroduced into the economy. At this point, there is no more economic benefit from waste, just the cost of long-term monitoring of disposal facilities. The economic cycle restarts when recyclables are reintroduced as commodities, thus providing exponential economic opportunity and benefits.

There are tremendous economic impacts from recycling in the Commonwealth. As the Recycling Economic Impact study of 2017 illustrated, in 2015, the recycling marketplace directly employed over 66,000 people, while stimulating almost 110,000 indirect and induced jobs. The recycling marketplace contributed \$22.6 billion to Pennsylvania's gross state product. Every dollar of direct activity was matched by another dollar of combined indirect and induced value added. Within state government, in Fiscal Year (FY) 2019, the Department of General Services (DGS) Recycling Program collected nearly 4.5 million pounds of wastepaper in the Harrisburg-area alone, generating over \$45,000 in revenue.

Household hazardous waste (HHW) collection is not mandatory, but many municipalities and third-party sponsors hold numerous collection events each year, following approval by DEP. During FY 2018-19, a total of 236 events were held, at which 6,874 tons of HHW was collected. From 2015-2019, DEP awarded 377 Act 190 grants, totaling \$5.58M, to reimburse HHW program sponsors. These events collected 27,687 tons of materials; enough to fill 75 Boeing 747 airliners.

Electronic waste (e-Waste) can contain metals such as lead, cadmium, and mercury that, if not properly managed, can become hazardous waste. The Covered Device Recycling Act (CDRA) of 2010 established several requirements for manufacturers, retailers, and other entities to facilitate the recycling of electronic devices covered under the CDRA. In 2019, 63 registered manufacturers recycled 56.4 million pounds of e-Waste. Over the last five years, approximately 296 million pounds of e-Waste have been recycled, removing a heavy burden and potentially hazardous materials from the Commonwealth's waste stream. However, many residents still lack the opportunity to recycle televisions in a free and convenient fashion.

As a result of its firm commitment to utilize recycled products whenever possible, the Commonwealth of Pennsylvania purchased more than \$56 million worth of recycled products in FY 2018 and \$201 million worth of recycled products from FY2015-16 to FY 2018-19.

A number of Commonwealth agencies work on special recycling projects statewide. For instance, the Pennsylvania Department of Transportation (PennDOT) uses a wide variety of recycled materials in transportation projects, including plastic, aluminum, glass cullet, scrap tires, reclaimed concrete/asphalt/aggregate, fly ash, steel and blast furnace slag, spent foundry sand, compost, shingle tabs, cellulose fiber and biosolids. Also, in 2019, the Pennsylvania Department of Agriculture (PDA) collected and granulated over 116,000 pounds of plastic pesticide containers for recycling; PDA has multiple collection locations in 51 counties.

The environmental and economic benefits of Act 101 and recycling are real. There exists potential to make positive changes and realize even more benefits in the next few years. However, the continued draining of the Recycling Fund for non-recycling purposes limit DEP's ability to maintain a functioning recycling program, much less implement meaningful and productive change. Without adequate resources, the Department cannot implement many of the proposed improvements highlighted in this report.

The following recommendations will improve and expand DEP's recycling efforts to reduce waste:

- Diversion of organic waste from landfills by funding composting and anaerobic digestion projects.
- Keep recycling funds in the Recycling Fund.
- Support smaller, dual-stream and commingled waste recycling facilities.
- Create Research and Development grants to invest in emerging technologies.
- Fund regional public Material Recovery Facilities (MRFs) to create competition and increase stability in the cost of processing recyclables.
- Reinstigate a Waste Planning Section to evaluate new technologies, product evaluations and the consumption of recyclable materials in Pennsylvania.
- Oversee the development of a comprehensive education program to improve the quality of materials collected.
- Expand access to recycling through convenience centers. Ensure all Pennsylvanians have convenient access to all recycling options.

TABLE OF CONTENTS

INTRODUCTION TO ACT 101

Background

Successes

New Challenges from Recycling Contamination

BENEFITS OF RECYCLING

Economic Impacts

Environmental Benefits

RECYCLING IN PENNSYLVANIA

Introduction

Municipal Recycling Programs

Recyclable Materials

Total Tons Recycled by Category, 2015 – 2018

Tons Recycled by DEP Region, 2015-2018

Commonwealth Agency Recycling

Organics Management

Electronics Recycling

Household Hazardous Waste

Total HHW Materials Collected in Tons, 2015 - 2018

Recycling Market Development

Other Commonwealth Agencies

Recycling Education

Used Oil Recycling

MUNICIPAL WASTE MANAGEMENT PLANNING GENERATION & DISPOSAL

Municipal Solid Waste Disposed 2015 – 2019; Tons by Origin (In-State/Out of State)

PROGRAM FUNDING

Act 101 Grants

Grant Dollars Awarded by Year, by Grant

LOOKING TO THE FUTURE – THE START OF A NEW DECADE

Waste

Recycling

Education

Organics Recovery/Composting

EMERGING ISSUES & TECHNOLOGIES

Cost for Municipalities

Plastics

Solar Technology

RECOMMENDATIONS & CONCLUSION

Statutory

Policy

Regulatory

Introduction to Act 101

Since the enactment of the Municipal Waste Planning, Recycling and Waste Reduction Act (Act 101) over 30 years ago, there has been a recent, renewed interest in modernizing Pennsylvania's municipal waste management laws. As such, DEP, the waste and recycling industry, local governments, and members of the General Assembly have started to take a closer look at potential amendments to Act 101 due to technology advancements, recycling market conditions, and the necessity to plan for Pennsylvania's next chapter in municipal waste management and recycling. However, the repeated diversion of Act 101 Funds from its intended use for recycling programs has thwarted intentions for change and jeopardizes the continued operation of the Commonwealth's recycling programs.

Evaluations of Act 101 and identification of opportunities for improvement were conducted by DEP and its Solid Waste Advisory Committee (SWAC) and Recycling Fund Advisory Committee (RFAC). These evaluations are integrated throughout this report.

Background

Act 101 was signed into law on July 28, 1988, as the culmination of a greater focus on the management of solid waste both in Pennsylvania and on a national level. This focus was triggered by the widespread attention brought to the illegal disposal of hazardous waste and the resulting groundwater contamination caused by Love Canal in the 1970s. The federal Superfund statute resulted, and the concern with groundwater contamination shifted attention to management of other solid wastes, including municipal waste.

Pennsylvania's focus on municipal waste management and development of stricter regulations dates to 1977. Regulations at the time didn't include liner requirements for landfills and were generally outdated. At the same time, the heightened attention on mismanagement of solid waste and its impacts resulted in the cleanup of smaller scale "town dumps." This led to a landfill capacity crisis that also needed to be addressed. As a result, the 1980s focused on developing comprehensive legislation that integrated municipal waste planning, disposal, and recycling into one of the nation's most successful programs. Consequently, Pennsylvania's updated municipal waste regulations were also promulgated in 1988.

Act 101 listed four major goals (Chapter 1, Section 102, Paragraph (c)):

- 1) At least 25% of all municipal waste and source-separated recyclable materials generated in Pennsylvania on and after January 1, 1997, should be recycled;
- 2) The weight or volume of municipal waste generated per capita in Pennsylvania on January 1, 1997, should, to the greatest extent practicable, be less than the weight or volume of municipal waste generated per capita on the effective date of this act;
- 3) Each person living or working in Pennsylvania shall be taught the economic, environmental and energy value of recycling and waste reduction and shall be encouraged through a variety of means to participate in such activities; and,
- 4) The Commonwealth should, to the greatest extent practicable, procure and use products and materials with recycled content and procure and use materials that are recyclable.

In addition, the minimum goals were to freeze municipal waste generation rates at 1988 levels, recycle 25 (later 35) percent of waste materials, and ensure 10 years of disposal capacity.

Prior to Act 101, Pennsylvania relied on landfills to manage most of its municipal waste. Resources that are now recognized as recyclable commodities were typically hauled away from the alley or curb as trash, illegally dumped, or burned in backyard burn barrels. Pennsylvania counties identified 167,000 tons of materials recycled in 1988. Thirty years later, recycling and composting in Pennsylvania are diverting about 6 million tons from disposal annually.

The last 30 years have seen several amendments to both Act 101 and the municipal waste regulations. In recent years, technology advancements, market conditions, and the necessity to plan for Pennsylvania's next chapter in municipal waste management and recycling have caused DEP to begin to take a closer look at potential amendments to the act.

This evaluation began to take shape in meetings of DEP's Solid Waste Advisory Committee (SWAC) and Recycling Fund Advisory Committee (RFAC) in 2016. Initial priorities discussed in these meetings included universal access to waste collection and recycling; increased and consistent education about recycling; flexibility in developing recycling programs; and the critical need to eliminate the sunset date of the Recycling Fee, as it is the sole funding source for the grant programs established by Act 101. In anticipation of the General Assembly introducing a bill to address the Recycling Fee, DEP staff in the Bureau of Waste Management's (BWM) Division of Waste Minimization and Planning developed a broader list of ideas to be addressed if Act 101 was to be amended. This list was provided to Secretary Patrick McDonnell on August 30, 2016.

In 2017, the renewed interest in Act 101 expanded. The waste industry developed its own list of priorities for amendments and brought these ideas to DEP in meetings held in February, March, and April of 2017. In May, DEP established a planning team to form a workgroup to facilitate discussions amongst the stakeholder groups about amendments to the act. The Act 101 Workgroup was established and was charged with recommending potential amendments to the act that all stakeholder groups could agree were needed ("consensus amendments"). DEP decided to utilize the RFAC as the primary membership of the Workgroup, as it is comprised of representatives of the main stakeholder groups party to Act 101 (i.e., waste and recycling industry, local government, and the legislature). As such, meetings of the Workgroup were held in conjunction with the regular meetings of DEP's SWAC beginning June 29, 2017; and concluding on December 12, 2018. The Workgroup also held two Special Meetings on January 30 and November 5, 2018, for a total of eight meetings. The consensus amendments of the Workgroup were considered in the writing of this document and included to the maximum extent practicable.

Successes

Of the four major goals included in Act 101, Pennsylvania has had the most success related to recycling. The Commonwealth has met and exceeded the first goal of Act 101. In 2018, 5.5 million tons of resources were recycled by Pennsylvanians. Presently, about 90% of the Commonwealth's population has access to some type of recycling. However, given the increased participation in recycling among Pennsylvanians, the goal of recycling 25% of all municipal waste and source-separated recyclable materials generated is no longer an appropriate measure of the success for Pennsylvania's recycling program. The content of the municipal waste stream is

continuously evolving to include more light weight containers which skews weight-based metrics and represents the impacts of the recycling program as stagnant or insignificant.

The Commonwealth has realized measurable economic and environmental benefits from recycling since the enactment of Act 101. The analysis of recycling programs should always include the economic and environmental benefits of recycling versus waste disposal. There is a cost of collection, transportation and processing for both recycling and disposal. This has been a point of confusion, as many Pennsylvanians are under the false assumption that recycling is free. The significant difference occurs at the end of the cycle when waste is disposed, while recyclables are reintroduced into the economy. At this point, there is no more economic benefit from waste, just the cost of long-term monitoring of disposal facilities. The economic cycle restarts when recyclables are reintroduced as commodities, thus providing exponential economic opportunity for an undefined period. These benefits are described in detail under “Benefits of Recycling.”

New Challenges from Recycling Contamination

With the inception of recycling, in many municipalities, residents had to sort their own recycled goods for curbside pickup. This required residents to make sure their glass recyclables were separate from aluminum cans, for example, and be cognizant of the quality of the materials they were recycling. However, advances in technology and a desire to reduce collection costs throughout the 1990s and early 2000s created a “single stream” recycling system that has become the standard in waste recycling among the United States. Single stream recycling allows people to place plastic, paper, glass, aluminum, and other recyclable materials in the same recycling bin which is then taken to a Materials Recovery Facility (MRF) where recycled materials are sorted out and sold.

However, single stream collection and processing of recyclables, as well as a lack of education on what can be recycled and how to recycle across the United States, has led to high levels of contamination of recyclables. Glass is a primary example. Because glass typically breaks at some point in the recycling process; either when it’s dumped into the waste truck, is compacted, or is dumped onto conveyor belts to be processed by a MRF. In the single stream system, this broken glass then ends up contaminating other recycled content like paper or cardboard. Ultimately, MRFs cannot separate recyclables as well as what is done at the home and curbside.

In 2017, China began taking steps to eliminate the importation of waste and ceased purchasing the United States’ recycled content in 2018. Since then, many stakeholders have raised concerns about recycling and markets. Single stream collection and processing of recyclables, as described above, was and continues to be a contributing factor to the loss of China as a viable market.

Single stream technology is still lowering the quality of valuable commodities in the recycling stream and will require significant capital investment if it continues to be the primary collection and processing technology. There are some single stream facilities in Pennsylvania and across the U.S. that generate higher quality materials and focus on domestic markets. These facilities have remained competitive and were less impacted by changes from China. The challenges from single stream technology have resulted in some Pennsylvania communities reverting to commingled, source separated, or dual stream collection; being forced to eliminate glass

collection; and implementing other changes to improve the marketability of the materials they collect.

In response to China's policy change, many Chinese entities are exploring opening MRFs in North America, with the intent to capture North American recyclables without bringing waste and residue back to China. This directly correlates to China's need for large volumes of higher-quality recyclables. Domestic markets are still consuming large amounts of recyclables and are being forced to expand. Those materials that were formerly exported to China are now difficult to recycle, as the quality of those materials is unacceptable for domestic markets. Even after quality improvement occurs, this material competes with that of companies already having long-term relationships with recyclers focused on domestic markets. Markets are also growing and evolving in response to changes in packaging and new consumer products.

It is important to note that the overall recycling marketplace is global; no one country can host or sustain markets for all the recyclables they generate. There will always be fluctuations in the prices for recyclables that mirror the economy. Consistent supply and minimizing contaminants are the best course of action against market fluctuations.

Benefits of Recycling

Economic Impacts

The Commonwealth has realized measurable economic and environmental benefits from recycling since the enactment of Act 101. The business of recycling provides sales revenues, jobs, and tax benefits to the local and state economy. The analysis of recycling programs should always include the economic and environmental benefits of recycling versus waste disposal. There is a cost of collection, transportation and processing for both recycling and disposal. This has been a point of confusion, as many Pennsylvanians are under the false assumption that recycling is free. The significant difference occurs at the end of the cycle when waste is disposed, while recyclables are reintroduced into the economy. At this point, there is no more economic benefit from waste, just the cost of long-term monitoring of disposal facilities. The economic cycle restarts when recyclables are reintroduced as commodities, thus providing exponential economic opportunity for an undefined period.

Employment

- In 2015, the Recycling Marketplace in Pennsylvania directly employed over 66,000 people, while stimulating almost 110,000 indirect and induced jobs.
- Activity related to the Core Recycling Sectors supported over 32,000 direct, indirect and induced jobs. This was matched by over 122,000 Downstream Manufacturing jobs and almost 21,000 Reuse/Remanufacturing jobs.
- For every direct job within the Recycling Marketplace, an additional 1.7 jobs are supported in Pennsylvania.
- For every job associated with the Core Recycling Sectors, an additional 4.4 jobs are supported in Pennsylvania.

Output

- Every \$1,000 in direct output (sales activity) leads to an additional \$700 in indirect and induced sales activity.
- Every \$1,000 of output in the Core Recycling Sectors leads to more than \$5,000 of output across the Downstream Manufacturing and Reuse/Remanufacturing Sectors.
- Every \$1 million in direct output supports six workers throughout the direct, indirect, and induced categories.
- Every \$1 million of output related to the Core Recycling Sectors supports 21 workers in the Recycling Marketplace.

Value-Added Contribution to Gross State Product (GSP)

- In 2015, the Recycling Marketplace contributed \$22.6 billion to Pennsylvania's GSP. Every dollar of direct activity was matched by another dollar of combined indirect and induced value added.
- Activity related to the Core Recycling Sectors lead to \$3.8 billion of value added contribution to GSP in 2015. The corresponding figures for the Downstream Manufacturing and Reuse/Remanufacturing Sectors were \$17.3 and \$1.5 billion, respectively.

Labor Income

- The average labor income per direct job within the Recycling Marketplace was almost \$73,000 in 2015.
- The average labor income across the direct, indirect, and induced categories was \$64,500, approximately 23% above the state average.

Government Revenues

- IHS Markit estimates the Recycling Marketplace generated \$1.7 billion in state and local taxes and \$2.7 billion in federal taxes in 2015.
- Direct economic activity within Pennsylvania totaled \$635 million in state and local taxes and about \$1.3 billion in federal taxes during 2015.
- Activity in the Downstream Manufacturing Sectors lead to \$1.3 billion and \$2.0 billion in federal taxes or about three-quarters of both tax categories.

Environmental Benefits

Costs and benefits of recycling are usually measured in dollars and tons – dollars spent on collection or gained in sales; tons diverted from disposal and marketed as feedstock. Too often, the environmental benefits of recycling — what the planet gains in pollution reduction or resources saved — are not factored into the equation. Public and private sector officials need to be aware that not only is recycling a business, it's also an environmental protection program meant to enhance the quality of life for Pennsylvania's residents and the world.

The United States Environmental Protection Agency's (EPA) Waste Reduction Model (WARM) of May 2019 was created to help solid waste planners and organizations track and voluntarily report greenhouse gas emission reductions, energy savings, and economic impacts from several different waste management practices. Using WARM, the Commonwealth's recycling effort can be converted into environmental benefit equivalencies realized as a result of recycling nearly 27.5 million tons of material between 2015 and 2018.

Recycling reduces greenhouse gas emissions:

- Over 39,682,785 metric tons of CO₂ emissions were avoided.
- This is equivalent to removing 8.57 million vehicles from the road.

Recycling saves energy:

- 6.7 million homes' worth of electricity was saved.
- This is also equivalent to conserving the annual energy use of 4.57 million US households.
- This is also equivalent to saving over 4.4 billion gallons of gasoline!
- This is also equivalent to 1.6 billion BBQ grill propane cylinders!

Recycling saves natural resources:

- Over 268 thousand acres of forest were saved from conversion to cropland.
- This is also equivalent to conserving 51.5 million acres of forest storing carbon.

Recycling in Pennsylvania

2015-2018 Materials Diverted: 27.45 million tons

Introduction

Pennsylvania's recycling program, which requires larger municipalities to recycle and encourages smaller communities to do so, has enjoyed enormous success. When the program started in 1988, less than two percent of the municipal waste generated was recycled. Pennsylvania was fortunate to have glass, metals and paper industries that were already accepting materials for recycling, but in 1988, its total recycling infrastructure was minimal. Despite this, there was great enthusiasm to make recycling work.

The recycling infrastructure developed alongside local collection programs, which provided a consistently growing supply of materials. The \$2-per-ton fee on all waste disposed at municipal waste landfills and incinerators established by Act 101 helped pay for local collection programs, public education, materials processing and composting facilities, equipment, and technical training. DEP and local recycling programs gave top priority to educating the public on recycling materials and buying recycled products. Pacesetter businesses voluntarily established recycling and waste reduction programs; most realized cost savings — some of them enormous — and told other businesses how they did it.

Companies, colleges, individuals, and government agencies took up the challenge to develop new uses for recycled materials, new processes, and new equipment. A number of manufacturers developed uses for waste by-products and thereby increased their profits. In at least one case, a small farm community retrofitted old farm equipment to assist their voluntary recycling program. State and local governments revised procurement procedures to give preference to recycled products and stimulate recycling markets. Retail merchants showcased recycled products. Government and private enterprises constructed “green” buildings using recycled materials and products. The development of computers and the Internet coincided with the expansion of recycling, and stakeholders promptly made use of the wonderful new tools to build more efficient programs. Pennsylvanians were on a creative roll in an environmental cause.

In 2017 and 2018, nearly 1,500 of the Commonwealth’s 2,628 municipalities — representing approximately 89 percent of the population — collected 6.4 and 5.5 million tons of recyclables respectively and delivered them to 179 processing facilities and other markets. All told, Pennsylvania’s 6,373 recycling and reuse establishments employ 175,586 people and do \$50.9 billion worth of business annually. This report celebrates those accomplishments and the Pennsylvanians who make recycling work.

Municipal Recycling Programs

Pennsylvania counties reported recycling over 27 million tons from 2015-2018, the most recent data available.

Mandated Communities

Act 101 mandates recycling in municipalities with populations over 10,000 and those with populations between 5,000 and 10,000 that have population densities greater than 300 persons per square mile. At present, 472 of Pennsylvania’s 2,628 municipalities are mandated to recycle and provide curbside collection programs. These municipalities collect yard and leaf waste and at least three materials from a menu of eight (8) materials — steel/tin and aluminum cans, plastics, clear and colored glass, office paper, newspaper, and corrugated cardboard — from residents. They also provide recycling education and enforce their recycling ordinances.

Non-Mandated Communities

Of the communities not required to recycle, 649 have a voluntary curbside program, of which, 298 are mandated by a local ordinance.

Total Number of Programs

Pennsylvania has a total of 1,930 recycling programs within 1,498 communities across the Commonwealth. These programs serve an estimated 89 percent of the state's population. These programs include 809 municipalities with drop-off programs.

Type of Program	Number of Municipalities
Act 101 Mandated Curbside Collection	472
Mandated by Local Ordinance Curbside Collection (Voluntary)	298
Voluntary Curbside Collection	351
Drop-off Collection	809
Total Number of Programs	1,930

Recyclable Materials

Pennsylvania distinguishes between "standard" and "nonstandard" recyclable materials. "Standard" materials refer to those covered by the U.S. standard recycling calculation, developed by EPA and the Council of State Governments to enable comparisons of recycling results between states. These include all the materials specified in Act 101, plus food wastes, textiles, tires, and white goods (table below). Pennsylvania's recycling programs also collect "non-standard" materials — notably construction and demolition wastes, used oil and aluminum scrap.

Total Tons Recycled by Category, 2015-2018

Material	Total
Single Stream	
[SS1] SINGLE STREAM - All recyclables, including fiber, collected together	3,796,758.05
Commingled	
[XXX] COMMINGLED - 2 or more recyclables collected together, fiber separate	480,633.57
Glass	
[GL1] Clear Glass – bottles, jars	36,504.69
[GL2] Mixed Glass – bottles, jars	86,392.58
[GL3] Green Glass – bottles, jars	8,879.57
[GL4] Brown Glass – bottles, jars	17,227.35
[GL5] Plate Glass	50,177.12
[GL6] Other Glass	30,089.52
Glass Total	229,270.83
Paper	
[C01] Cardboard - corrugated	4,296,857.75
[C02] Brown bags and sacks	13,310.56

[C03] Gabled/Aseptic Cartons - milk, juice, etc.	6,729.43
[PA1] Magazines and Catalogs	54,035.89
[PA2] Newsprint / Newspaper	231,332.01
[PA3] Mixed/Other Paper Grades - junk mail, paper board, computer paper, chipboard	1,110,179.70
[PA4] Office Paper - all high grades	371,812.44
[PA6] Phone Books	5,331.22
[DR3] Drum Fiber	8,158.47
Paper Total	6,097,747.47
Plastics	
[PL1] #1 Plastic (PET) - Polyethylene Terephthalate	19,072.57
[PL2] #2 Plastic (HDPE) - High Density Polyethylene	26,676.98
[PL3] #3 Plastic (PVC) - Unplasticized and Plasticized Polyvinyl Chloride	11,485.52
[PL4] #4 Plastic (LDPE) - Low Density Polyethylene	19,295.58
[PL5] #5 Plastic (PP) - Polypropylene	7,674.85
[PL6] #6 Plastic (PS) - Polystyrene and Expanded Polystyrene	1,959.94
[PL7] Mixed/Other Plastic	103,013.43
[PL8] Film Plastic	36,031.24
[DR1] Drum Plastic (HMW HDPE)	5,904.51
[DR4] Drum Plastic (Mixed Bulky Rigid)	6,759.23
Plastics Total	237,873.85
Metals	
[AA1] Aluminum Cans	37,490.22
[F02] Steel and Bimetallic (Tin) Cans	88,950.23
[MX2] Mixed Cans	13,387.03
[AA2] Aluminum Scrap	150,191.83
[F01] Ferrous metal	2,418,957.29
[N01] Non-ferrous metal	219,709.89
[N02] Copper	43,996.72
[N03] Brass	36,240.29
[N04] Lead	40,990.19
[N05] Stainless Steel	947,336.79
[N10] Nickel	1,512.20
[W01] Wire/Cable	27,471.71
[MM1] Mixed Metals - includes Drum Steel	1,092,498.26
[F03] White Goods	486,539.33
Metals Total	5,605,271.98
Household Hazardous Waste	
[O02] Antifreeze	268.69
[B01] Batteries: Lead-Acid	5,581.50
[B02] Batteries: Other Household	1,432.03
[CR1] E-Waste - includes televisions	78,743.64
[FL1] Fluorescent Tubes and CFLs	557.94
[OL2] Used Oil	4,354.51
[OL3] Oil Filters	113.44
[HHW] Other (paints, varnishes, pesticides, etc.)	4,173.79

Household Hazardous Waste Total	95,225.54
Commercial Hazardous Waste	
[O02] Antifreeze	9,344.29
[B01] Batteries: Lead-Acid	684,571.23
[B02] Batteries: Other Household	5,055.13
[CR1] E-Waste - includes televisions	74,489.53
[FL1] Fluorescent Tubes and CFLs	3,118.89
[OL2] Used Oil	530,579.98
[OL3] Oil Filters	20,110.05
[CHW] Other (paints, varnishes, pesticides, etc.)	8,206.13
Commercial Hazardous Waste Total	1,335,475.23
Other	
[ASP] Asphalt	1,373,841.12
[M01] Rubber Tires	215,808.23
[M02] Construction and Demolition	3,251,383.96
[M03] Clothing/Textiles	61,563.02
[M04] Furniture and Furnishings	46,918.35
[MT1] Mattresses	1,586.69
[MIS] Miscellaneous/Other Consumer Items	122,616.91
Other Total	5,073,718.28
Organics	
[SSF] Source Separated Foods	1,009,146.19
[WW1] Wood Waste	1,126,991.76
[Y01] Yard and Leaf Waste	2,356,164.71
Organics Total	4,492,302.66
Grand Total	27,444,277.46

Act 101 Tonnages Recycled 2015-2018
13,237,187.46

Non-Act 101 Tonnages Recycled 2015-2018
14,207,090

Tons Recycled by DEP Region, 2015-2018

NORTHWEST REGION Meadville Office (814) 332-6945
Tons Recycled....1.535 million

NORTHCENTRAL REGION Williamsport Office (570) 327-3636
Tons Recycled....1.347 million

NORTHEAST REGION Wilkes-Barre Office (570) 826-2511
Tons Recycled....7.871 million

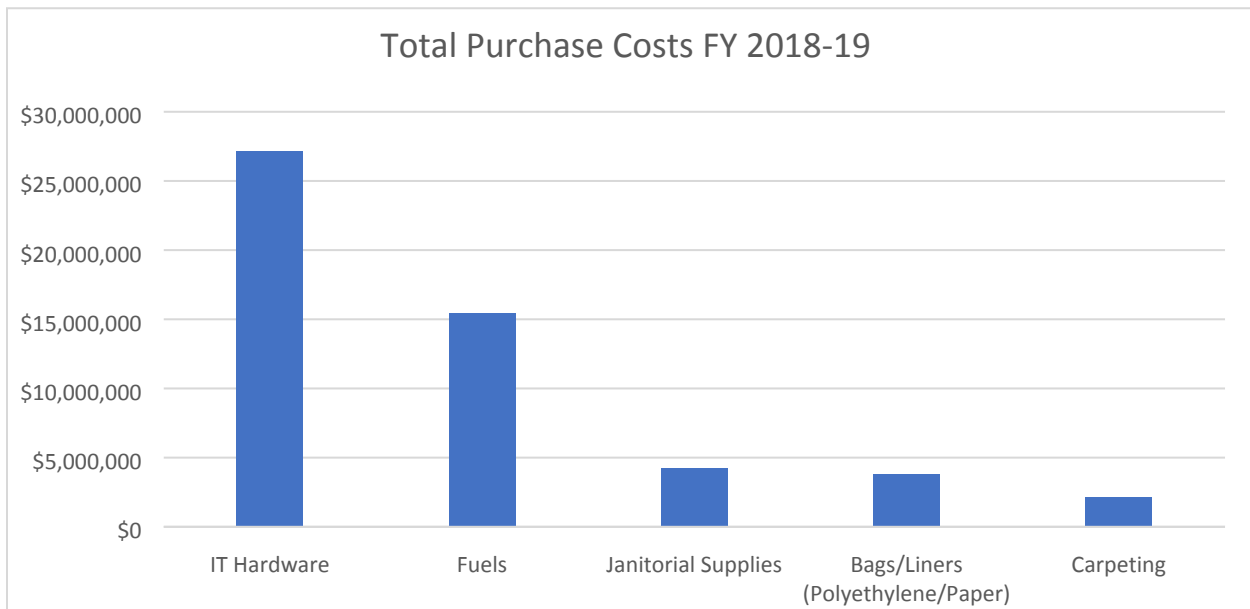
SOUTHWEST REGION Pittsburgh Office (412) 442-4000
Tons Recycled....4.408 million

SOUTHCENTRAL REGION Harrisburg Office (717) 705-4700
Tons Recycled....4.486 million

SOUTHEAST REGION Norristown Office (484) 250-5900
Tons Recycled....7.794 million

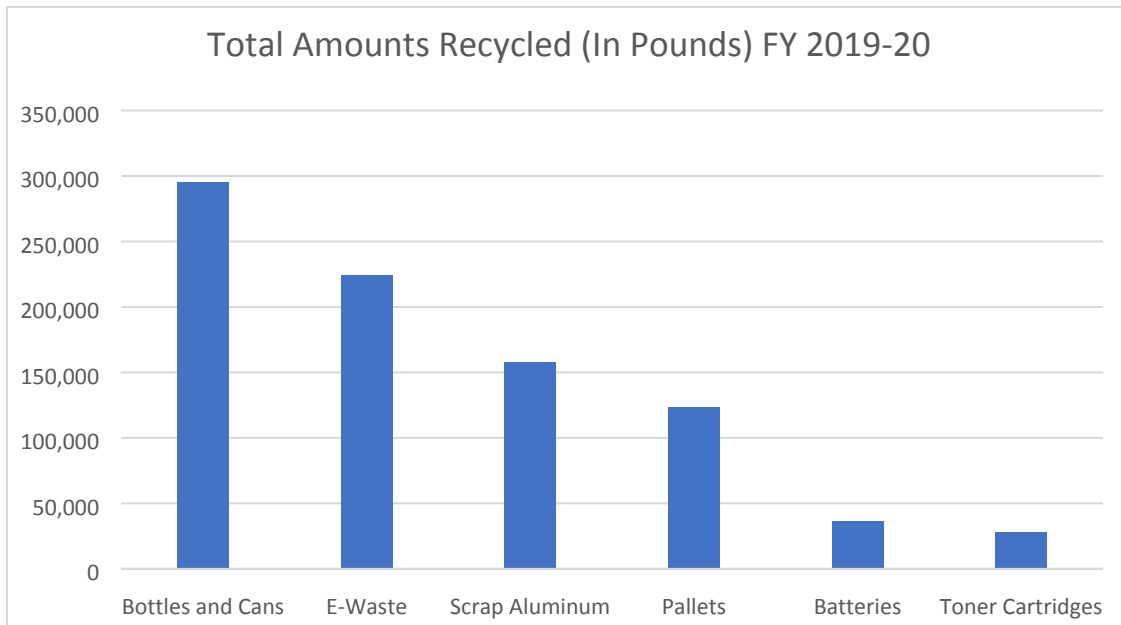
Commonwealth Agency Recycling

As a result of its firm commitment to utilize recycled products whenever possible, the Commonwealth purchased more than \$201 million worth of recycled products from FY 2015-16 to FY 2018-19. In FY 2018-19, the most recent FY with complete data available, the Commonwealth purchased over \$56 million in recycled products. The graph below contains a partial list of recycled products purchased and the amounts spent for FY 2018-19. For more information on state government procurement, visit <https://www.dgs.pa.gov/Materials-Services-Procurement/Pages/default.aspx>.

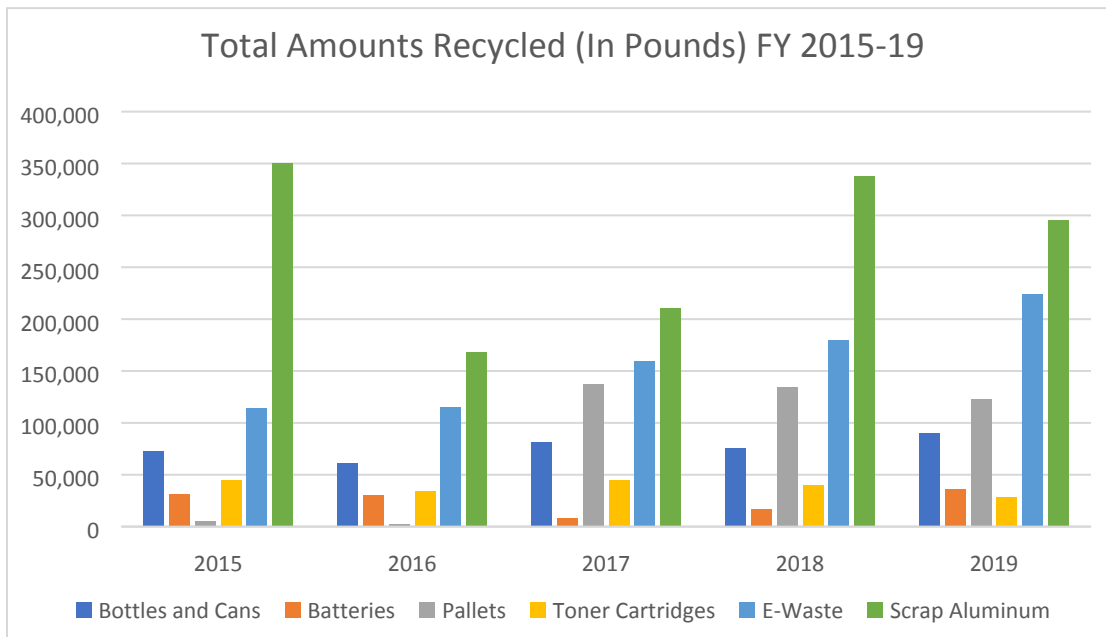


Collected products for recycling is another key component of the Commonwealth's overall plan. In FY 2019-20, DGS's Commonwealth Agency Recycling Program collected over 4.8 million pounds of waste fiber -- 4.4 million pounds of which was collected in Harrisburg -- which generated \$45,432 in total revenue.

The program also recycles numerous other items including bottles and cans, shrink wrap, plastic drums, toner cartridges, batteries, waste oil, electronic waste, pallets, and more. The graph below shows a partial list of the amounts of recycled products collected in FY 2019-20.



The graph below shows a partial list of the amounts of recycled products (in pounds) collected over the last five years.



The total amount of products recycled from these six categories alone – over 1,627 tons -- is seven times the weight of the Statue of Liberty! With that perspective in mind, it's easy to see why DGS's Commonwealth Recycling Program is such an essential part of the everyday operations in Pennsylvania.

Organics Management

DEP supports diverting food and leaf waste from disposal through Act 101 grants and recycling technical assistance for the collection and management of leaf and food waste. Nearly 500 public and private composting and processing facilities exist in Pennsylvania today. This success is due in part to Act 101's prohibition of truckloads primarily comprised of leaf waste from disposal at landfills and waste-to-energy incinerators; and leaf waste collection requirements for Act 101 mandated recycling municipalities. DEP has recently created the Food Recovery Infrastructure Grant program to divert consumable food from disposal by providing approximately \$9.6 million for food banks and associated food distribution entities. These funds allowed these entities to transport, accept, and prepare increased amounts of food that would have previously been disposed.

DEP, via the Energy Programs Office and the Bureau of Waste Management, has initiated a study to identify the renewable energy generation potential from the diversion of institutional, commercial, and industrial (ICI) sources of food waste from the solid waste stream. The scope of this study will focus on food waste that should be recycled following the implementation of prevention and recovery activities as outlined in EPA's Food Waste Hierarchy (<https://www.epa.gov/sustainable-management-food/food-recovery-hierarchy>). The project will result in a statewide assessment - using existing sources of data such as the EPA Excess Food Opportunities Map (<https://www.epa.gov/sustainable-management-food/excess-food-opportunities-map>) as well as other public and propriety datasets - to identify major producers (those generating more than 52 tons per year) of ICI food waste across Pennsylvania. In addition, it will inventory and determine the capacity of current digesting and composting infrastructure to process food waste from ICI sources and calculate the renewable energy generation potential and greenhouse gas emissions reductions from diverting this waste.

This assessment will provide DEP with:

1. The estimated volume and location of major producers of recyclable ICI food waste across the Commonwealth.
2. The capacity and location of facilities to process ICI food waste to the highest and best use through digestion or composting activities. In addition, the assessment will identify facilities that do not currently have the ability to process ICI food waste but could be modified to accept waste with limited capital and programmatic support.
3. Renewable energy generation potential as well as the greenhouse gas emissions reductions from diverting the food waste identified in the assessment.
4. Pursuable short and long-term strategies to increase the rate of diversion of food waste from the solid waste stream, increase renewable energy generation, and reduce greenhouse gas emissions.

The analysis will ultimately provide DEP with the foundation to participate in larger, cross-functional, food waste reduction strategies with other Commonwealth agencies, non-profits, and the private sector. Funding for this project is anticipated to be provided wholly or in part from the United States Department of Energy (DOE) State Energy Program (SEP).

Early data from DEP's Waste Composition Study is revealing that organics continue to comprise more than one third of municipal waste. This portion of the waste stream presents an opportunity to reduce the landfilling of organics and ultimately a reduction in greenhouse gas emissions.

The reduction in the disposal of organic materials is a high priority for DEP. There are several sustainable options to manage organic materials available to residents and businesses of Pennsylvania. DEP will further develop an organics infrastructure that will provide convenient access to food recovery, composting and/or anerobic digestion, prior to a decision to disposal at a municipal waste landfill or processing at a resource recovery facility.

Electronics Recycling

Overview

The Covered Device Recycling Act (CDRA or act), the act of November 23, 2010, P.L. 1083, No. 108, 35 P.S. §§ 6031.101 et seq., established requirements for manufacturers, retailers, and other entities to facilitate the recycling of electronic devices covered under the CDRA.

The CDRA established a producer responsibility program with the objective of offering readily available recycling opportunities to Pennsylvania residents. Under the act, manufacturers shall collect and recycle an amount equal-to or greater-than their two-year prior sales (in pounds) of covered devices. The CDRA also bans the disposal of covered devices in landfills. All costs associated with the collection, transportation, and recycling of covered devices under a CDRA recycling plan are to be paid by the manufacturer, making this one of the few remaining programs where residents do not incur a direct cost for recycling.

What is a Covered Device?

The act defines “covered device” as a computer device or television device marketed and intended for use by a consumer. This includes televisions, desktop computers, laptop computers, computer monitors, tablets, eReaders and computer peripherals.

The table below offers a list of common household electronic devices and their distinction as a covered device under the CDRA.

Type of Device	Covered?
Computer Peripherals (Keyboards, Mice)	YES
Desktop & Laptop Computers	YES
Printers, Scanners & Copiers	YES
Tablets & eReaders	YES
Televisions & Computer Monitors	YES
Air Conditioners, Dehumidifiers, Refrigerators/Freezers	NO
Batteries (Alkaline, Lithium-Ion, Nickel Cadmium)	NO
Camcorders & Digital Cameras	NO
Cellphones, Cordless Telephones, Smartphones	NO
Gaming Consoles (Nintendo, PlayStation, Xbox)	NO
GPS Devices	NO

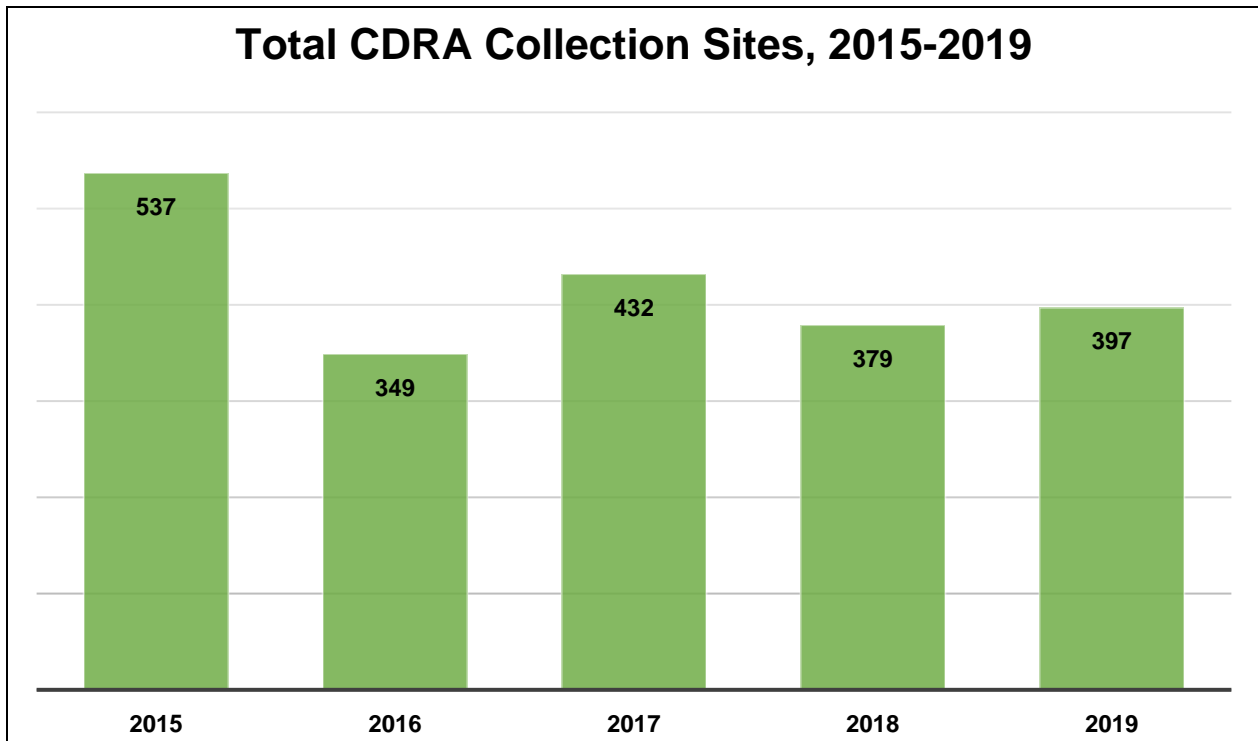
Home Audio Equipment (Radios, Stereo Systems, Speakers/Sound Bars)	NO
Kitchen Appliances (Blenders, Coffee Makers, Microwave Ovens, Toasters)	NO
Major Appliances (Washers, Dryers, Dishwashers, Ranges/Stoves)	NO
Personal Audio Equipment (MP3 Players, Bluetooth Speakers, Headphones)	NO

How does the CDRA affect Pennsylvania residents?

Since the implementation of the act, residents may no longer dispose of covered devices in their municipal solid waste. Instead, the CDRA includes language that requires manufacturers to offer electronics recycling options to Pennsylvania residents. CDRA collections may not collect a fee from residents utilizing this service unless the resident is offered a financial incentive of equal or greater value, such as a coupon or rebate. The financial incentive may come from a retailer offering sale of new covered devices, or a manufacturer of new covered devices. It is important to note that not every electronics collection in Pennsylvania is a CDRA collection program, and those collections acting independent of the act may charge a collection fee to the resident.

The language in the CDRA, as it relates to collection sites, is somewhat indeterminate. While the act requires manufacturers to offer collections to residents, it does not require that all collection sites accept all types of covered devices, nor does it require that all collection sites serve residents of all townships, municipalities, boroughs, cities or counties. In general, CDRA collection sites accept computers and peripherals, while most do not collect televisions and/or computer monitors without restriction. The act requires the DEP to maintain a list of CDRA collection sites. However, it is important to remind residents that not every collection site included on the list will accept televisions, which happen to be the item most likely to be recycled.

The graph below illustrates the annual total number of CDRA collection points for each program year, 2015 through 2019.



There are three annual requirements of covered device manufacturers under the act:

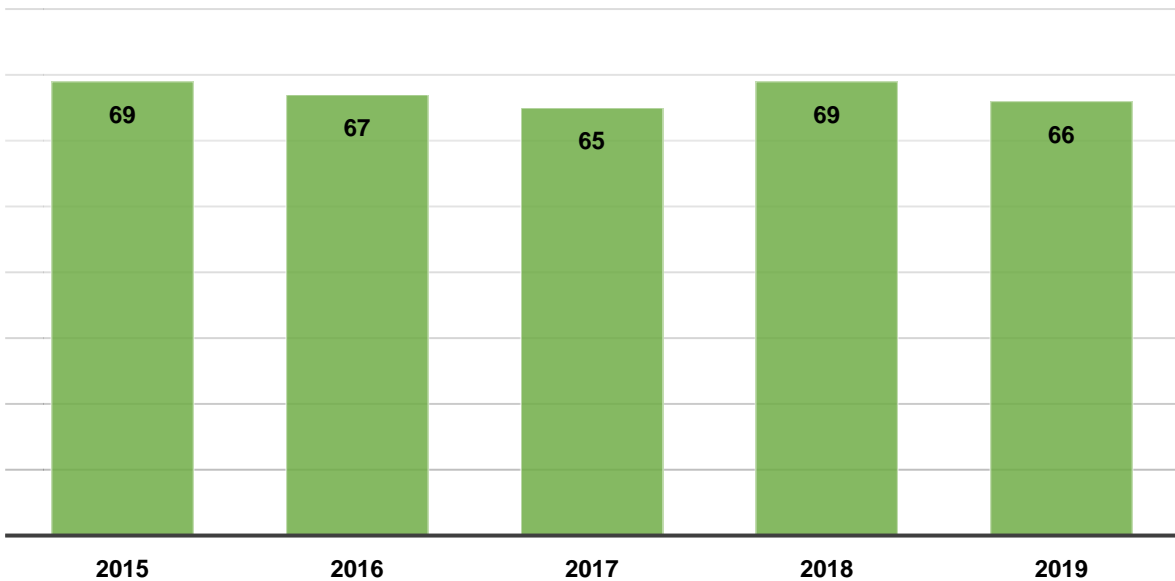
1. Registration

Prior to offering sale of a covered electronic device to Pennsylvania residents, whether through brick and mortar retailers or via online sales, manufacturers are required to complete a CDRA registration form and submit an annual registration fee in the amount of \$5,000. Registration forms and payments are due by August 31st, prior to the beginning of the respective program year. The registration fee is intended to fund the administration of the CDRA program, while the form is completed to satisfy the following data collection requirements under the act:

- Manufacturer contact information;
- Brands manufactured by and/or licensed to each manufacturer;
- Type of device(s) manufactured by and/or licensed to each manufacturer;
- Total weight of covered devices, in pounds, sold nationally during the calendar year two years prior; and
- Total weight of covered devices, in pounds, sold in Pennsylvania during the calendar year two years prior, as calculated using the Pennsylvania population multiplier (historically around 4 percent)

The graph below illustrates the annual total number of manufacturers registered during each program year, 2015 through 2019.

Total Registered Manufacturers, 2015-2019



2. Covered Device Recycling Plan

Once a manufacturer has been selling covered devices in Pennsylvania for two years, they will be required to submit and adhere to an approved Covered Device Recycling Plan (Plan) to collect and recycle an amount of material equal to, or greater than, their Pennsylvania sales weight during the calendar year two years prior, as stated on their CDRA registration form. This is referred to as an “annual recycling obligation”. Plan forms are also due by August 31st, prior to the beginning of their respective program year.

For material to be counted towards a manufacturer’s annual recycling obligation, the material must meet all four of the following criteria:

- Collected from Pennsylvania residents or small businesses (<50 employees);
- Collected at no charge to the resident or small business;
- Collected during the appropriate program year; and
- Recycled by a certified R2 or e-Stewards recycler.

Manufacturers may, and generally do, contract with recyclers and/or collectors to collect, transport and recycle material on their behalf. They may also contract with a group plan manager to satisfy any/all compliance efforts on their behalf.

An approved Covered Device Recycling Plan includes the following:

- A list of all certified recyclers contracted to recycle and process material on behalf of the manufacturer;
- A list of all collection sites to be utilized by Pennsylvania residents, and the types of devices accepted at these sites;
- Instructions associated with the manufacturer’s mail back program, if applicable;
- The total weight of material (in pounds) intended to be collected and recycled; and

- Signatures of intent from the manufacturer and all contracted recyclers, certifying that all material will be collected, transported, recycled, and processed in accordance with the CDRA.

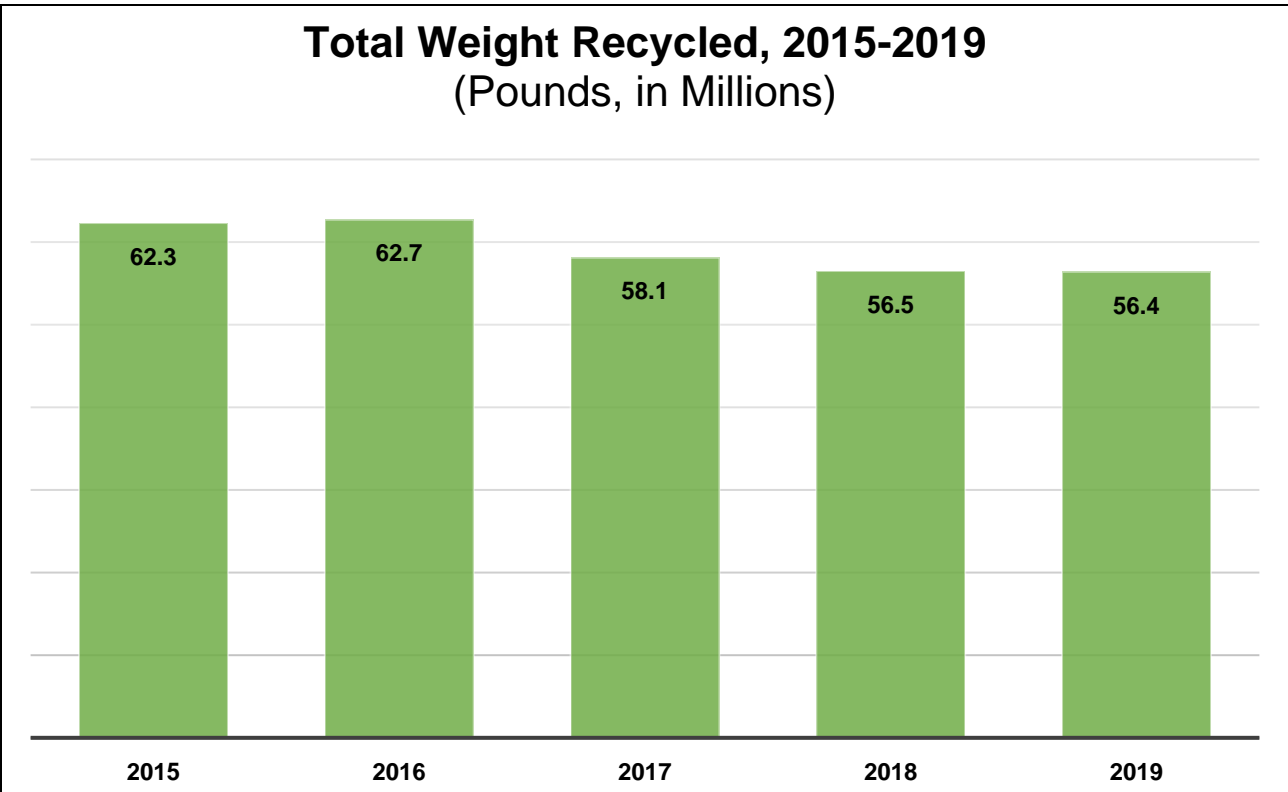
3. Annual Reporting

The annual report form is an end-of-year assessment of the manufacturer's adherence to their approved recycling plan. This form is due by January 31st, following the end of the program year. The data included in the annual report form is used to confirm that the manufacturer has satisfied all recycling requirements under the act. This data is also collected to determine the total weight of covered devices recycled through the CDRA program.

Data collected through the annual report includes:

- A breakdown of the weight of material recycled by each recycler included in the Covered Device Recycling Plan;
- The total weight of material recycled through the Plan;
- Any additional recycling facilities utilized by the manufacturer that may not have been included in the Plan;
- Any additional collection sites utilized by the manufacturer that may not have been included in the Plan;
- A detailed description of how cathode-ray tubes (CRT) were handled and processed by the recyclers included in the Plan; and
- Signatures from the manufacturer and all contracted recyclers, certifying that all material was collected, transported, recycled, and processed in accordance with the CDRA.

The graph below illustrates the total amount of material recycled through the CDRA program during each program year, 2015 through 2019. Through the past five years, a total of over **296 million** pounds of covered devices have been recycled through the CDRA program.



Problems with the CDRA

Since the inception of the program, the most critical issue plaguing the CDRA has been weight-based recycling obligations. Under the act, recycling obligations are based on sales of new covered devices (in pounds), rather than the amount of material residents wish to recycle. As manufacturers continue to produce smaller, lighter devices, residents are almost always purchasing a device that is lighter than the device they are replacing. This has created a situation where buying a new device and recycling the old device is no longer a one-for-one exchange, creating an impasse of material that falls outside the responsibility of the manufacturer to recycle under the CDRA.

Issues continue with the collection and processing infrastructure necessary to implement the CDRA. DEP continues to work with the operators and managers of recycling collection programs to evaluate the existing collection and processing infrastructure. The same concerns DEP has heard previously are more prevalent due to the absence of reliable funding, low market values for materials, and the uncertainty of having the collected material covered by a manufacturer’s plan.

The CDRA has not stimulated a dependable statewide infrastructure to ensure local governments, collectors, and recyclers are able to operate and provide recycling services on a continuing basis. Collection infrastructure continues to be inadequate because recyclers are hesitant to contract with counties as some collected electronics are not covered by manufacturers’ goals.

Televisions and computer monitors that contain cathode ray tubes (CRT) continue to be problematic for recycling due to the leaded glass in the CRTs; absence of low-cost recycling technology; and limited number of CRT processors. The high cost of transporting CRTs to

processors and the actual processing cost is greater than the value of the material recovered, which creates a negative value commodity. In response, some entities have reduced, limited, or eliminated CRTs from collection programs. Nevertheless, the demand for opportunities to recycle old televisions continues to be high. Reports indicate that, by weight, approximately two-thirds of the materials recycled from households are CRT-containing electronics, such as televisions.

Efforts to explore new technologies for processing CRT glass are ongoing; however, none of these efforts have yet to be successfully deployed. In late 2018, a major CRT glass end-market stopped taking shipments, citing regulatory challenges.

The CDRA requires manufacturer programs to provide recycling access to 85 percent of the population; however, the landfill ban prohibiting the landfilling of covered devices applies to 100 percent of the population. These provisions in the CDRA continue to result in a confounding situation for residents that may have limited or no opportunities for recycling but are faced with a landfill ban on the material they wish to discard. A 2019 Pennsylvania Recycling Markets Center analysis reported that collection infrastructure diminished to the point of eight collection sites in Pennsylvania that take covered devices without restriction. This reduction leaves only 23.7 percent of the population with unrestricted access to recycling opportunities under the CDRA. Restrictions on recycling sites invariably involve television recycling. Consequently, the ongoing inadequacy of viable television recycling options has exacerbated the proliferation of illegal television dumping as reported by county recycling coordinators.

Non-CDRA Electronics Collections

Electronics recycling does occur outside the scope of the CDRA in Pennsylvania. Electronics collectors and recyclers are not required to contract with a manufacturer in order to collect or recycle electronics in Pennsylvania and may choose to operate independent of the CDRA and collect items in addition to the covered devices defined in the CDRA. Any electronics collections events held in Pennsylvania must register and meet the approval of DEP prior to accepting material. Recyclers processing this material in Pennsylvania must possess a current R2 or e-Stewards certification, as well as a valid General Permit Number WMGR081 from DEP's Waste Management Program.

Unlike CDRA collections, these collections are not subsidized by electronics manufacturers and may accept payment from the entity hosting the event and/or the resident at the point of collection.

Household Hazardous Waste (HHW)

HHW collection events play a pivotal role in minimizing and managing waste within Pennsylvania. Some examples of HHW are paint, pesticides, pool chemicals, drain cleaners, batteries, and motor oil. Although HHW collection is not mandatory, many municipalities and third-party sponsors hold numerous collection events each year, following approval by the DEP. Below is a chart with relevant data from the last five fiscal years:

Fiscal Year	Total # of Events	# of Participants	Materials Collected (pounds, millions)
2018-19	236	151,795	13.74
2017-18	230	164,871	13.85
2016-17	189	148,237	12.13
2015-16	92	97,187	7.44
2014-15	63	131,835	8.18
Total	810	693,925	55.34

Over 55 million pounds of HHW has been collected across the Commonwealth at one-day and on-going collection events since the start of the 2014 fiscal year. For perspective, that's the equivalent of over 11,000 mid-size automobiles or 75 Boeing 747 airliners! By weight, batteries, used oil and electronics are the most popular items to recycle.

Sponsors of HHW collection programs with DEP approval are eligible to apply for reimbursement of part of the incurred costs. Under the Small Business and Household Pollution Prevention Act (Act 190), DEP can reimburse up to 50 percent of eligible HHW program costs, not exceeding \$100,000 per county per fiscal year. Funding priority is given to existing programs and those operated by counties, multi-county groups, and first- and second-class cities, as required by Act 101. Below is a table listing the total amount of reimbursement for the last five years:

Year	Total HHW Grant Reimbursement
2019	\$1,025,814.47
2018	\$1,186,984.70
2017	\$1,297,243.94
2016	\$973,821.59
2015	\$1,122,821.64
Total	\$5,606,686.34

Total HHW Materials Collected in tons, 2015-2018

<i>Household Hazardous Waste</i>	
Antifreeze	268.69
Batteries: Lead-Acid	5,581.50
Batteries: Other Household	1,432.03
E-Waste - includes televisions	78,743.64
Fluorescent Tubes and CFLs	557.94
Used Oil	4,354.51
Oil Filters	113.44
Other (paints, varnishes, pesticides, etc.)	4,173.79

Household Hazardous Waste Total	95,225.54
Commercial Hazardous Waste	
Antifreeze	9,344.29
Batteries: Lead-Acid	684,571.23
Batteries: Other Household	5,055.13
E-Waste - includes televisions	74,489.53
Fluorescent Tubes and CFLs	3,118.89
Used Oil	530,579.98
Oil Filters	20,110.05
Other (paints, varnishes, pesticides, etc.)	8,206.13
Commercial Hazardous Waste Total	1,335,475.23

Recycling Market Development

Recycling Market Development is a critical component to successful recycling, both to ensure a demand for recycling feedstock on the front end of the manufacturing process, and on the back end as products are produced and ultimately purchased which contain post-consumer Act 101 recycled materials.

Much of the recyclable material collected in Pennsylvania is transported, processed, and converted into commodities within Pennsylvania, contributing to the Commonwealth's economy. Pennsylvania's glass, steel and most paper industries depend on recycled feedstock for their manufacturing processes. The use of recycled plastic containers in the manufacture of laundry product bottles, automotive parts, nursery containers, parking stop bumpers and various forms of plastic lumber continues as a growth industry in Pennsylvania.

Fence posts and split-rail fencing made from recycled plastics in Saylorsburg, Monroe County, can be seen in National Parks and Forests across the country. Recycling receptacles made from recycled aluminum, steel and plastic lumber in Kempton, Berks County, are also distributed widely in the U.S.

Pennsylvania Recycling Markets Center (RMC)

With DEP funding, the Pennsylvania Recycling Markets Center Corporation (501c(3)) (RMC) began operations as a Pennsylvania non-profit corporation in July 2005. Formed and funded by the Department, the RMC was designed to encourage the continued growth and economic health of the Commonwealth's recycling and reuse industries. The existence of the RMC and its functions directly support the market development requirements of the recycling program plan that was legislated in 2002 through Act 175, which amended Act 101.

The RMC has the mission to reduce or eliminate barriers that lead to new expanded use of Pennsylvania's recycled materials. The RMC team brings market development assistance to a near endless list of stakeholders including entrepreneurs, manufacturers, recycled material processors, collection programs, haulers, and governmental agencies. Through market development assistance, the services of the RMC begin at the demand side of the recycled materials market, not with traditional supply at the household or business. The RMC has an

affiliation with the Pennsylvania State University (Penn State) and is headquartered at Penn State Harrisburg with an office in Pittsburgh. Core areas of RMC outreach include feedstock supply connectivity, applied research and commercialization assistance; technology acceleration; and concierge service as a curator of technical and business growth information. Building and supporting Pennsylvania's \$22.6B recycling marketplace with over 120 years of combined professional recycling industry experience, the RMC bridges relationships between economic development and use of Pennsylvania's recycled materials supply.

The RMC is governed by its Board of Directors and supported by a President/CEO and professional staff. With inclusion of ex-officio Board Directorates, there are 26 states represented through the RMC Board, offering broad industry feedback from RMC to the Commonwealth.

Featured Successes

AeroAggregates of North America, LLC

With introductions by an RMC Board Director which followed with RMC technical assistance to AeroAggregates, LLC, the ultra-lightweight foam glass producer is well on its way to success. The team at AeroAggregates demonstrated their vertical climb to success, earning both the RMC 2017 William M. Heenan Markets Development Award and a 2018 Governor's Award for Environmental Excellence.

With capacity this year to produce upwards of 32,000 tons of ultra-lightweight foam glass while using curbside post-consumer, mixed color glass, the engineered lightweight aggregate is used for many applications including structural support along both I-95 in Philadelphia and at the Langley Avenue project in the Philadelphia Naval Yard. Additional applications include sound barriers; growing media; green roof systems; floating blankets; and much more.

Given the ultra-lightweight aggregate is made from recycled glass and a foaming agent, the RMC worked with AeroAggregates to verify that upon laboratory analysis it did not present the silicosis hazard that can accompany use of other aggregates.

Post-consumer recycled glass solutions have expanded greatly while directly benefitting Pennsylvania communities. At a time when processing residues are being questioned, AeroAggregates makes use of post-consumer glass that often ends up in Material Recovery Facilities' residue. AeroAggregates is clearly a circular economy leader, providing value to the local economy and developing high-value, high-volume product from what may have previously been unfeasible to recover.

(L) Ultra-Lightweight Aggregate required in design of new Langley Avenue in Philadelphia Navy Yard expansion. Bottle and container glass sourced from Philadelphia recycling program. Ultra-Lightweight structural, supportive aggregate needed due to fill soils impacted by high water table.

(R) Ultra-Lightweight Aggregate used in Interstate-95 new ramp construction, north Philadelphia near Cottman Avenue. Ultra-Lightweight Aggregate required as a result of unstable soil embankment near project with adjacent, legacy utility lines. Fear of using conventional stabilization media includes damage or crushing of utility services.

PittMoss®

What began as a kitchen experiment in 1994 grew into a part-time venture, a Shark Tank sensation, and ultimately, a successful business that manufactures a sustainable alternative to sphagnum peat moss. PittMoss®, LLC, is a premium provider of horticulture growing media that is not harvested from peat bogs. As environmental issues related to peat mining and carbon emissions become more understood, PittMoss® offers a cost-effective, recycled-content alternative that is better for both plants and the planet.

The RMC assisted PittMoss® by extending their existing product testing, advising on the manufacturing process, and evaluating and securing feedstock. PittMoss® was also a recipient of the William M. Heenan, Jr. Recycling Markets Development Award for its commitment to recycling and innovation. Now, PittMoss is selling about a quarter-million pounds per year of recycled content potting mixes.

The PittMoss® product – a plant-customized, proprietary blend of organic and nutrient additives combined with recycled paper and cardboard – was created to replace the Canadian sphagnum peat moss imported each year by greenhouses, nurseries, and home gardeners. Over the last five years PittMoss is not only proven to grow bigger healthier plants with less water and fertilizer - but also has a profound impact on the environment.

Since its inception, PittMoss has helped reduce carbon emissions by 3,000 metric tons by replacing carbon emitting peat moss. This is the equivalent of burning 3.3 million pounds of coal or driving 7.4 million miles, an astounding feat for such a small, growing company. What most people don't know is that the average bag of peat-based potting soil has a carbon emission equivalent to burning 22 pounds of coal, so for each bag of potting soil replaced by PittMoss, that is how much CO2 emissions can be reduced.

In addition, as manufacturing feedstock, PittMoss has used more than enough paper and cardboard to fill approximately 50,000 average flowerpots. Less quantified is the massive amount of water saved by using this hydrophilic soil replacement as well as an incredible amount of fertilizer runoff reduced since the soil retains nutrients so much better than existing soils.

Weis Markets

Weis Markets, headquartered in Sunbury, Pennsylvania, is a full-service family-owned grocery chain. The company employs more than 19,000 associates in 205 stores and support facilities in Pennsylvania, Maryland, New York, New Jersey, Delaware, Virginia, and West Virginia. Committed to developing a corporate strategy that defines themselves as socially responsible, Weis Markets has implemented a sustainability program to minimize their impact on the environment, including providing recycling opportunities that are convenient and effective.

The RMC has provided technical assistance to Weis Markets by conducting material reduction and recovery evaluations at select stores and ancillary operations. Waste generation and recycling opportunities were evaluated at each location where more than a dozen separate categories of material were sorted, weighed, and volumetrically estimated. Summaries of each included item specific data as well as recommendations for program improvements.

These material evaluations provided Weis Markets with baseline data to better understand the composition of the resources generated at a given store or operation. Moreover, potential opportunities were identified to assist with their journey toward zero waste that involves new waste reduction, reuse, and recycling initiatives. Through the partnership with RMC, Weis Markets has also been able to review the performance of existing material reduction and recycling efforts, particularly food waste diversion programs.

As a result of this RMC assistance, in 2016, Weis Markets has now achieved outstanding “boots on the ground” results. Weis Markets had an increase in recycling of 8.3% when compared to 2015 values, recycling 26,500 tons of cardboard, 607 tons of mixed paper, 786 tons of plastic bags, and 170 tons of recycled prescription pill bottles. This is approximately the equivalent weight of the Capitol Dome at the State Capitol in Harrisburg.

Pennsylvania-Manufactured Recycled-Content Products by Material Type

Wood

- Mulch
- Livestock bedding
- Pallet Refurbishing
- Heritage wood reuse
- Compost

Paper & Cardboard

- Paper cores and tubes
- Peat moss substitute growing media
- 100% and blends of recycled-content office paper
- 100% and blends of recycled-content cardboard
- Absorbent socks
- Notebooks
- Molded fiber packaging
- Livestock bedding
- Cellulose insulation
- Ceiling tile
- Gypsum board
- Paperboard, backing for board games
- Custom molded fiber products and packaging

Tires (Rubber)

- Drain covers
- Pitcher's mats
- Practice mats
- Animal feeders
- Water basins
- Flooring
- Mulch
- Vibration Dampeners
- Turf Shock Padding
- All weather running tracks
- Acoustic noise control
- Modified Asphalt Binders
- Retread and Reused Tires

Plastic

Stormwater drainage systems
Molded plastic packaging
Water-repellent fleece garments
Plastic strapping
Plastic edge protectors
Carpet, acoustic, and thermal fabric for the automotive industry
Parking stops
Waste and recycling roll-out carts
All weather fencing
Nursely pots
Plastic lumber, decking lumber
Bathroom partitions
Watering cans
Plastic drainage pipe
100% and blends recycled-content plastic bottles, #1 & #2
All weather chairs and furniture
Vehicle carpet

Glass

Septic water distribution media
Ultra-Lightweight Foamed Glass Aggregates
Expendable blasting abrasives
100% and blends recycled-content glass bottles and containers
Carpet backing fill
Wastewater solids management, reedbed anchor media
Water filtration media for community pools and spas
Structural PennDOT fill for drainage piping and other infrastructure applications
Cookware and Drinkware

Asphalt Shingles

Asphalt pavement
Crack sealant

Expanded Polystyrene

Picture frames

Gypsum

Lawn & Garden Soil Conditioner
Dairy Bedding and Absorbent
Poultry Litter Amendment
Horse Bedding Amendment
Industrial Fillers
Bulk Waste Solidifier
Non-Potable Water Clarifier

Steel

Piping
Structural Members
Construction Products
Cans and Pails
Reused Auto Parts

Aluminum

Steel Manufacturing Reducing Agents
 Beverage Cans
 Reused Auto Parts

Apparel

Fashion Accessories
 Leather Goods

Electronics

Primary Metals
 Reused Components

Other Commonwealth AgenciesPennsylvania Department of Agriculture:

The Plastic Pesticide Container Recycling (PPCR) Program continues to excel in the quantity of containers recycled. The collection system depends on a network of pesticide distributors and/or commercial pesticide application businesses to accept clean, empty plastic pesticide containers from all types of pesticide applicators, regardless of point-of-purchase. The PPCR program has recycled over 2.4 million pounds of plastic pesticide containers since the program began in 1994 and has served as a model for establishing other programs across the nation.

Plastic Pesticide Container Recycling Program Totals	
Year	Pounds Collected
2015	119,825
2016	N/A
2017	123,365
2018	116,100
2019	116,040

Pennsylvania Department of Transportation (PennDOT):

In cooperation with the DEP since 2000, PennDOT's Strategic Recycling Program (SRP) has conducted research; implemented and reported on demonstration projects throughout the Commonwealth; and conducted outreach to the engineering community to promote and encourage the use of recycled materials in PennDOT's operations. Since its inception, the SRP has researched and completed evaluations of scrap tires, crumb rubber, glass cullet, waste plastics, recycled asphalt pavement (RAP), recycled concrete aggregate (RCA), fly ash, various types of slag, asphalt shingles, compost, and more.

Collaborating with district design staff, the SRP has assisted in the implementation and development of Hot In-Place (HIP) recycling of pavements, as well as furthering the use of waste mixed plastics. HIP recycling is an in-situ process which attempts to restore the pavement in preparation for a surface wearing coat placement. In the FY2016/2017 period, three projects encompassing approximately 10.7 miles of roadway in Allegheny, Armstrong and Indiana Counties were a part of the HIP study.

The SRP has also completed research and pilot testing designed to identify opportunities to recycle the Maintenance Department's out of service polyethylene brine tanks into new brine tanks or other products used by the Commonwealth. While unsuccessful in finding an economic solution, this research led to further examination into incorporating hard-to-recycle plastics into asphalt pavements.

PennDOT's SRP team also considered 'waste' recycling of materials generated by PennDOT's operation and routine materials used in maintenance. Specifically, PennDOT recycled and replaced old dilapidated wooden benches and tables with recycled plastic varieties and identified handicap ramps constructed of recycled plastic.

With strong encouragement from DEP, PennDOT's SRP team is assessing the use of various post-consumer plastics in asphalt pavements. Several opportunities that use hard-to-recycle HDPE and LLDPE plastics as an asphalt binder extender are being assessed; these products identify good opportunities for both their potential technical (performance and lifecycle) and cost benefits to PennDOT and the Commonwealth. The SRP team is collecting global performance data and specifications to identify necessary data inputs to PennDOT's design model. The SRP team will collaborate with the RMC to identify a Pennsylvania recycler that can meet the plastics QA/QC and quantity requirements for one or more test sections. It is noted that even at a two or three percent (by weight) substitution within the bitumen equates to thousands of pounds of plastics per lane mile in a 2-inch thick asphalt overlay. PennDOT is optimistic that one or more pilot projects will be planned, implemented, and monitored.

The SRP has also provided support on an engineering project to re-use historically significant Pennsylvania structures. The project entails engineering studies to assess the feasibility and needs to relocate two iron truss bridges located in Chester and Crawford Counties for a trail project located in Tioga County.

Recycling Education

A key goal of Act 101 is to educate residents in Pennsylvania about the benefits of waste reduction and recycling. Education is a critical component of ensuring each generation understands how to recycle and why it is important to do so. DEP has a history of using media campaigns, classroom training, and its recycling website to support local educational programs and statewide initiatives.

However, a change in direction during a previous administration defunded and re-prioritized those efforts. Therefore, many Pennsylvania residents do not understand how to correctly recycle, and the variation of what materials can be recycled on a municipal basis. This leads to further confusion about recycling. To ensure that all Pennsylvanians understand how to recycle and the associated environmental and economic benefits of recycling, the Commonwealth must reprioritize its recycling educational efforts.

Recycling Website

The Commonwealth's online recycling content is among the most frequently visited areas on DEP's website. Generally broken down into two categories – residents and businesses – online visitors can access a wealth of information spanning topics such as household hazardous waste,

composting, electronics recycling, grant opportunities, prescription drug disposal, and much more. Updates regarding the availability of HHW curbside collection programs in Pennsylvania communities, one-day electronic waste and tire collection events, and contact information for county recycling coordinators are posted on a regular basis to ensure residents have access to the most up-to-date information. Frequently asked question sections are a new feature installed on several web pages to simplify the process of safe disposal of potentially harmful materials.

To access these features, as well as the rest of the recycling content available online, please visit the main Recycling and Waste Reduction page at <https://www.dep.pa.gov/Citizens/RecyclingDisposal/Pages/default.aspx>.

Recycling Technical Assistance

For over 20 years, DEP has been providing recycling technical assistance to local governments for improving recycling efficiency. During 2015, the program was conducted in partnership with the Pennsylvania State Association of Township Supervisors; starting in 2016, the program has been conducted by SCS Engineers. The technical assistance is provided at no cost to the local government. Project reports are posted on DEP's website at <https://www.dep.pa.gov/Business/Land/Waste/Recycling/Municipal-Resources/TechnicalAssistance/Pages/default.aspx>.

Below is the list of 59 projects approved from 2015 through 2019:

Municipality	Project Type
Douglass Township	Pay-as-you-throw
Borough of West Chester	Food Waste
York County SWA	C&D Waste
Centre Region COG	Brush Collection
Borough of Ambridge	Review of Program
City of Washington	Review of Program
Towamensing Township	Drop-off Recycling
South Lebanon Township	Compost Site review
Cambria County SWA	Drop-off Recycling
Crawford County SWA	Recycling Study
West Mead Township	Composting
City of Pittsburgh	Curbside Recycling
Clearfield County SWA	Convenience Center
Borough of West Chester	Collection Evaluation
Plainfield Township	Collection Evaluation
City of Reading	Yard Waste Processing
East Greenville Borough	Recycling Program Efficiency
City of Harrisburg	School Recycling
City of Philadelphia	Recycling at Airport
Montgomery County	HHW Collection Site
Morton Borough	Recycling Ordinance
Carlisle Borough	Organics/Leaf Waste
Stroud Township	Pay-as-you-throw
Jefferson County SWA	Drop-off Recycling
Delaware Water Gap Borough	Leaf Collection
Bristol Township	Recycling Education
Dallas Area Municipal Authority	Recycling Evaluation
Uwchlan Township	Glass/Single Stream
City of Scranton	Pay-as-you-throw
Allen Township	Curbside leaf collection service
Greenville Borough	Commercial recycling

Willistown Township	Curbside Recycling
Bridgeport Borough	Curbside Recycling
Clinton County Solid Waste Authority	Recycling Education
Borough of Geistown	Composting
Milford Borough	Curbside Recycling
Greenville Borough	Residential recycling
West Brandywine Township	Recycling Ordinance
West Caln Township	Recycling Ordinance
Media Borough	Food Waste
Zelienople Borough	Curbside Recycling
Hatboro Borough	Curbside Recycling
Wernersville Borough	Organics/Leaf Waste
Tredyffrin Township	Recycling Ordinance
Caln Township	Recycling Program Improvements
Upper Dublin Township	Composting - food scraps
Harborcreek Township	Composting
Lower Frederick Township	Curbside Recycling
City of New Kensington	Recycling Program Improvements
Fayette County	Recycling Program Review
City of Reading	SW Education & Enforcement Program (SWEEP)
City of Altoona	Material Recovery Facility Opportunities
Spring Township	Composting Opportunities
West Grove Borough	Recycling Collection Efficiency
Pike County	Residential Recycling Guide
Franklin Park Borough	Recycling Contamination Issues
Cumberland County	Yard Waste Equipment Sharing Program
Butler Township	Commercial Recycling/ Solid Waste Ordinance
Upper Chichester Township	Collection Evaluation

Pennsylvania Recycling Hotline

The Commonwealth's toll-free Recycling Hotline (1-800-346-4242) has operated since 1984 to assist Pennsylvanians who need to know where to recycle. Over the years, DEP has expanded the hotline's services to take requests for literature on recycling, recycled products, used oil recycling and household hazardous waste. The hotline provides feedback on the reach of DEP's print and media advertising efforts, as well as weekly reports on calling trends, including the origin and nature of calls. In 2019, the hotline accepted just over 1,700 calls, for an average of 33 calls per week. For that year, the majority of calls received concerned covered devices (TVs, computer equipment). In fact, there was not a week where covered devices were not the leading item of concern; they averaged 46% of the calls, with some weeks accounting for up to 70% of the calls

Used Oil Recycling

Some programs collect and recycle wastes that cause problems when improperly disposed. Fifty counties have sites that accept waste oil (motor oil, used oil, cooking oil/grease, oil gasoline mixture) from the public.

Act 89 of 1982, the Used Oil Recycling Act, established a voluntary, statewide program to collect and recycle used motor oil generated by people who change their own oil. The program depends on the voluntary participation of service stations, garages, and other sites able to accept used oil from the public. Currently, 564 sites in 50 counties accept used oil.

Do-it-yourself oil changers can obtain used oil recycling information on DEP’s website using www.dep.pa.gov/Citizens/RecyclingDisposal/MotorOil/Pages/default.aspx or by calling the Pennsylvania Recycling Hotline. Collection sites are listed by county and include addresses, telephone numbers and hours of operation.

Municipal Waste Management Planning Generation & Disposal

Pennsylvania’s ample disposal capacity at municipal waste landfills and resource recovery facilities, and its proximity to other populous states, results in a net importation of municipal waste. Over the last five years, 39 million tons, or 35 percent, of the waste disposed in Pennsylvania municipal waste landfills and resource recovery facilities originated in 25 other states, the District of Columbia and Puerto Rico. Pennsylvania relies on other states for disposal of minor amounts of municipal waste and for disposal of all hazardous waste generated in the state. It is estimated that during those five years, the Commonwealth exported approximately 1.5 million tons of municipal waste to bordering states. This data coupled with the recycling data provides the monitoring, analysis, and planning for the integrated management of municipal waste. The ability to manage and analyze this data is essential to plan successful programs and prioritize regulatory and statutory changes.

The re-creation of the Waste Planning Section would provide DEP the insight, data and analysis needed to modify programs, policies, and regulations in accordance with the evolution of current waste management and recycling technologies and practices. Planning is a foundational element of Act 101 and is of the utmost importance to any attempt to modernize Act 101.

Municipal Solid Waste Disposed 2015-2019: Tons by Origin

Total Waste	<u>Total Waste Disposed</u>	<u>In-State</u>	<u>Out-of-State</u>
CY 2015	21,420,797.30	14,307,779.90	7,113,017.40
CY 2016	21,441,348.80	13,899,022.90	7,542,325.90
CY 2017	22,709,554.20	14,853,736.90	7,855,817.30
CY 2018	23,740,088.30	15,445,953.90	8,294,134.40
CY 2019	24,076,523.80	15,544,387.70	8,532,136.10
5 Year Total	113,388,312.40	74,050,881.30	39,337,431.10
*The information for this table is available on the department’s website			

Program Funding

Act 101 programs are financed by a \$2-per-ton recycling fee on all waste disposed in landfills or processed by resource recovery facilities in Pennsylvania. Since the inception of the Recycling

Fund in 1988, the fee has generated \$1.2 billion in revenue and through legislative transfers has provided approximately \$187 million to other environmental programs and the General Fund.

Counties and municipalities receive most of the funding to help pay for their solid waste management programs. This is generally done through the administration of grants. From 2014 through 2019, DEP awarded approximately 3,700 grants totaling over \$164 million to counties and municipalities to develop and expand local recycling, planning and other waste management programs, for an aggregate of over 24,000 grants totaling over \$887 million since 1988. The tables below outline the distribution of these grants over the last five years.

Act 101 Grants

County Planning Grants (§901)	Reimburse 80 percent of the approved costs of preparing county municipal waste management plans and related studies. The grant also reimburses county expenses for HHW education.
Recycling Program Grants (§902)	Reimburse 90 percent of the approved costs of county and municipal recycling programs.
Recycling Coordinator Grants (§903)	Reimburse 50 percent of a county recycling coordinator's salary and approved expenses.
Recycling Performance Grants (§904)	Reward counties and municipalities for recycling results. The grants are based on population and type/weight of materials marketed.
Host Municipality Inspector Grants (§1102)	Reimburse host municipalities 50 percent of the approved costs to employ a certified landfill or resource recovery facility inspector.
Independent Permit Evaluation Grants (§1110)	Pay host municipalities up to \$10,000 for an independent engineering review of a landfill or resource recovery facility permit application.

901 Grant Dollars Awarded by Year, 2015-2019:

Year	2019	2018	2017	2016	2015
Planning grants awarded	5	9	4	4	5
In dollars:	\$355,660	\$404,544	\$222,014	\$215,093	\$289,822
HHW grants awarded	7	9	6	14	n/a
In dollars:	\$222,118	\$275,222	\$180,630	\$556,458	n/a

902 Grant Dollars Awarded by Year, 2015-2019:

Year	2019	2018	2017	2016	2015
Grants Awarded	86	195	n/a	120	102
Dollars awarded, in millions	\$13.3	\$37.2	n/a	\$17.1	\$16.8

903 Grant Dollars Awarded by Year, 2015-2019:

Year	2019	2018	2017	2016	2015
Grants awarded	58	59	58	57	58
Dollars awarded, in millions	\$1.82	\$1.78	\$1.74	\$1.61	\$1.68

904 Grant Dollars Awarded by Year 2015-2018:

Year	2018	2017	2016	2015
Grants awarded	712	688	718	737
Dollars awarded, in millions	\$20.3	\$16.1	\$16.0	\$16.5

1102 Host Inspector Grant Awards

Year	No. Apps Rec'd	Amt. Awarded
2015	31	\$349,440.38
2016	28	\$288,271.17
2017	24	\$240,779.22
2018	24	\$235,322.21
2019	22	\$201,761.64
2020	19	\$146,478.30
TOTAL	148	\$1,462,052.92

Looking to the Future – The Start of a New Decade

As this report was being prepared in mid-2020, there were some exciting projects initiated that will guide and modernize DEP's recycling and waste reduction programs into the future. This report has provided a foundation for these programs, along with concepts for further exploration and specific recommendations to modify Act 101. They are:

Waste**Waste Composition Study and Recyclables Composition Study Update**

In 2020, DEP initiated a \$500,000 waste composition study and recyclables composition study to characterize the municipal waste generated in Pennsylvania. This is an update of a similar study completed in 2003. Understanding the waste stream and its recyclable components is crucial to targeting resources, spending funds wisely and developing an effective recycling program. To obtain a comprehensive profile, waste from residential and commercial generators in urban, suburban, and rural areas will be sorted and weighed in all six DEP regions during each of the four seasons. The waste composition study will provide more accurate data on types of waste generated by Commonwealth residents. The recyclables composition study will characterize various recovered material streams and reject/residue streams at MRFs across Pennsylvania. Both studies will help with future recycling collection and market development efforts.

Universal Waste Collection

It is not possible that a homeowner, no matter the area or amount of land owned, can properly dispose of their waste on their own property. It is usually (in whole or in part) burned or buried on their property or illegally dumped in another area, violating Pennsylvania law, and causing environmental degradation. Some residents will utilize the waste receptacles of their neighbors or nearby businesses to dispose of their trash, either with consent or surreptitiously; this practice is a theft of services since the generator pays nothing for collection/disposal.

In order to be eligible for several existing Act 101 recycling grants, the applicant must have a mandatory waste collection program. There is a correlation between participating in a waste program and engaging a maximum effort to recycle. If one can burn, bury, or otherwise toss away unwanted materials, one is less likely to take the time and effort to recycle.

Act 101 should be modified to require all residents (directly or through a county ordinance) to utilize a waste collection service (county convenience centers and rural transfer facilities, discussed below, would both qualify). This would aid greatly in eliminating open burning and illegal dumping and disposal.

Disposal Bans

Metals and corrugated cardboard are a valuable resource that can and should be used rather than mining or cutting down trees for virgin materials. The market value of these materials remains high even with fluctuations in the overall recycling market. This makes it feasible to ban disposal of these materials for maximum benefit to the environment without being overly burdensome to local municipalities and the waste and recycling industries. The infrastructure for recycling these materials can be strengthened by:

- Modifying the municipal waste regulations to require additional processing at landfills and resource recovery facilities
- Modifying Act 101 to require municipal drop-offs specifically for aluminum, metal, and corrugated cardboard; and the municipal waste regulations to create a permit-by-rule (PBR) for Rural Transfer Facilities to help manage these materials
- Annually evaluating the feasibility of banning disposal of additional materials

In addition to taking steps to conduct an updated waste composition study as described above (see #3), the Bureau has begun development of regulatory changes to create a municipal waste PBR for rural transfer facilities to help inform the feasibility of banning disposal of these and additional materials. In addition to informing disposal bans, DEP will gain knowledge on the content of Pennsylvania's waste and recycling stream to better understand how these materials can be managed most effectively and efficiently by all stakeholders. A new PBR will provide a streamlined way to authorize additional management opportunities for these materials to be recycled in areas of the Commonwealth where curbside collection isn't immediately available, thereby capturing more of these materials for recycling.

Burn Ban

According to the Pennsylvania Department of Conservation and Natural Resources, one of the major causes of forest fires in Pennsylvania is debris burning. A careless person burning trash or yard waste can be responsible for causing wildfires that burn thousands of acres of valuable Pennsylvania forests. These fires most frequently start in someone's backyard and travel through dead grass and leaves into bordering woodlands. In fact, ninety-eight percent of the wildfires in

Pennsylvania are a direct result of people's actions, and place emergency responders directly in harm's way. They also tie up emergency responders and apparatus that serve the community in the event of traffic accidents, house fires, and other emergencies.

In the first quarter of 2020, fifty-one (51) wildfires occurred in southeastern Pennsylvania alone, resulting in one death. Most of these fires were the result of someone burning trash, brush, or vegetation. (Reading Eagle, March 1, 2020)

An EPA report published in November 1997 shows that a single household burn barrel may emit as much toxic chemicals as a well-controlled municipal incinerator.

Residential burning of waste is a dangerous and environmentally hazardous activity. While temporary burn bans have been instituted on a local, county and even state level when extremely dry conditions have been observed, it is time to end the practice of outdoor burning once and for all.

The Solid Waste Management Act (Act 97) requires anyone who burns waste to have a permit from DEP. Clearly DEP doesn't issue permits to individual homeowners to burn waste and recyclables; this provision regulates commercial incinerators and resource recovery facilities.

Act 101 requires certain municipalities to recycle at least three items they choose from a list of eight materials, plus leaf waste, as listed in and defined by Act 101. Burning of materials that are required to be recycled by a municipality is unlawful. However, air quality regulations allow single family dwellings to burn domestic refuse. The contradiction between these laws and regulations is confusing; allows for destruction of valuable commodities; and contributes to the pollution of the air and waters of Pennsylvania.

Act 101 should be modified to:

- Eliminate all open burning of waste.
- Clarify the definition of leaf waste to remove the confusion regarding what materials it includes.
- Eliminate the single-family dwelling domestic refuse burning exemption in the air quality regulations.

County Convenience Centers

A ten-year study (partially funded by DEP) was conducted by Keep Pennsylvania Beautiful in which more than 6,200 illegal dumps were identified across the Commonwealth. The study also conveyed several important findings: 1) remediation of dumping sites does not stop illegal dumping in the area; 2) there is less illegal dumping in areas where there is universal access to waste and recycling collection, and; 3) more than 87% of Pennsylvanians indicated that they would be willing to take their household waste, recyclables, or other items not collected at the curb to a convenient outlet and pay for the service.

The cost per ton to remediate an illegal dump can be 10- to 20-times higher than the cost to properly dispose of the material in the first place. While illegal dumping occurs in every county in the Commonwealth, it is most prevalent in the more rural counties where waste and recycling services are limited or non-existent.

The most prevalent items found in illegal dumps are household trash, construction & demolition waste, and tires. It is also in rural areas where electronic waste is difficult to recycle as few manufacturers' covered device recycling plans cover these areas.

In order to promote convenient local opportunities for responsible waste collection, as well as outlets for the collection of recyclables including electronics and tires, DEP is proposing a program that will support the establishment of rural "convenience centers." The program will provide seed money to establish the centers. For counties Class 6 – 8 (and possibly higher), allowing the development and implementation of county convenience centers would allow for a permanent facility to properly handle waste and recyclables.

These facilities are envisioned to be operated by the county but serviced by private sector businesses. Residents and small businesses would be able to bring waste, recyclables, and other items (e.g. HHW, bulky items) to the facility where these items would be stored until transported for disposal (waste) or processing (recyclables). These facilities will need operate under the rural transfer facilities PBR is already being developed if they plan to accept municipal waste. It is hoped that this program will be available by the end of 2022.

Product Stewardship

Product stewardship is an environmental management strategy that mandates whoever designs, produces, sells, or uses a product takes responsibility for minimizing the product's environmental impact throughout all stages of the product's life cycle, including end of life management. Extended Producer Responsibility, as defined by the Product Stewardship Institute, requires the shifting of financial and management responsibility, with government oversight, upstream to the manufacturer and away from the public sector.

Even prior to the advent of the novel coronavirus COVID-19 and the subsequent shut down of retail stores, consumer preference was moving toward online purchases for at-home deliveries. This preference is resulting in an increase in cardboard, foam, and film plastic materials generated to meet the demand for increased home deliveries. Other than cardboard, these materials are not easily recycled through Pennsylvania's curbside recycling collection programs, leading to an increase in disposal of these items.

DEP believes there is tremendous potential to minimize packaging waste and increase recycling and reuse through the use of product stewardship and extended producer responsibility. Requiring manufacturers and shipping companies to take financial and management responsibility of their products would effectively minimize waste and increase recycling and reuse of these particular materials. Therefore, DEP recommends modifying Act 101 to ensure that companies that manufacture or use packing materials such as foam and film plastic are required to assume the financial and management responsibility of the materials.

In addition to packaging, the disposal of spent solar panels appears to be a growing concern. Between January and March 2019, Pennsylvania saw 1,185 solar installation projects completed (Philadelphia Inquirer, 7/17/2019). The number of solar energy projects continues to grow as panels become more affordable and incentive programs (including those sponsored by the Commonwealth) are offered. However, solar panels do have a useful life, and some of the earliest projects are approaching that time. How these panels can be safely disposed of and where, or can they be recycled, are questions that will need to be answered soon. The manufacturers of these products should play a part in the solution to this issue.

DEP currently implements a producer responsibility program in the Covered Device Recycling Act (CDRA) of 2010, which requires specified electronic devices to be collected, transported, and

recycled by the manufacturers of the electronic devices. While there are inherent problems with the CDRA that minimizes DEP's ability to ensure proper recycling throughout the Commonwealth, using the concept of this producer responsibility law in more effective legislation would strengthen the Commonwealth's producer responsibility efforts when it comes to recycling electronic covered devices.

Reinstitute the Waste Planning Section and Include an Organic Management "CZAR"

The Waste Planning Section was eliminated from the Division of Waste Minimization and Planning in November 2009 (due to staffing cuts). The Section was focused on planning for the future of waste management and recycling; developing educational programs and materials; and documenting program successes and the underlying statistics. The Section should be reinstated with the following priorities:

- Development of informational packages documenting the economic and environmental benefits of recycling.
- Creation of a position to coordinate the management of organic materials in Pennsylvania and ensure counties develop and implement Organics Management Plans (see #7).
- Identification and implementation of industry-specific waste reduction programs and initiatives.

Recycling

2020 Census

With the results of the census (expected in the first half of 2021), the DEP anticipates several municipalities will meet, for the first time, the population thresholds in Act 101 for implementing mandatory curbside recycling programs. These municipalities will be given two years from the official release of the census data to come into compliance. To assist these municipalities, DEP will prioritize their requests for grant funding to cover collection equipment, ordinance development, and education costs.

Uniform County Curbside Programs

Philadelphia is the only Class 1 county in Pennsylvania. Comprised entirely of the City of Philadelphia, its population is mandated to recycle under Act 101. Philadelphia directs and coordinates the recycling practices and message for 1.526 million Pennsylvanians.

Many counties in classes below Philadelphia contain numerous mandated municipalities, encompassing a high percentage of their total county population (e.g., Allegheny, 89%; Bucks, 89.9%, Delaware, 91.3%; Montgomery, 91.5%). Those in Class 2 and 2A (population between 500,000 – 1,499,999), and possibly even Classes 3 – 5 (population between 90,000 – 499,999), could find advantages in being able to implement uniform, county-wide mandated curbside programs. Educational efforts, along with standard practices, would ease confusion and stimulate greater recycling efforts, making the overall program more efficient and effective. Mandating certain counties implement universal recycling, based on their population, is the logical next step from mandating local governments. Mandated counties would implement this requirement via the established planning process.

Education

Professional Recyclers of Pennsylvania (PROP) Partnership

In June of 2020, DEP entered into a partnership with PROP to conduct an extensive outreach to schools (K-12, colleges, and universities, public and private) regarding recycling. This outreach, which is envisioned to proceed well into the decade, will have two main areas of focus: recycling collection programs at schools; and, recycling education. The end results will be a comprehensive understanding of recycling activities within each school (with an emphasis to inspire new and expansive programs) and a vast array of educational materials to encourage students to recycle both at school and at home.

General Recycling and Waste Reduction Education Efforts

Education regarding waste reduction and recycling is a top priority of all the stakeholders party to Act 101, and one of the few items on which the Act 101 Workgroup achieved consensus. Recycling education in particular has been a priority of DEP for even longer; to support this effort, DEP worked with the RMC to conduct a study on the economic and environmental impacts of recycling in the Commonwealth, which has already been discussed. Previous experience with recycling educational programs has indicated they should:

- Normalize programs so recycling can be done the same way at home, work, or play.
- Support a consistent educational message across multiple audiences.
- Include development of a suite of educational materials for use by stakeholders at all levels.

This can be facilitated by reinvigorating DEP's educational campaign, programming and materials pertaining to waste reduction and recycling. The campaign will remind stakeholders of the hierarchy of waste management ("Reduce, Reuse, Recycle") and expand upon the "Recycle" component of the hierarchy. To aid in implementation, DEP will continue to capitalize on its partnership with the RMC to gather and report needed information on recycling and maximize distribution of consistently messaged information to stakeholders.

In addition, DEP can modify existing grant/incentive and permitting programs to require an educational component be considered and/or included in the development of a program or operation.

Organics Recovery & Composting

Food Recovery Infrastructure Grant (FRIG) Program

The recycling and/or reduction of food waste has been a goal of the DEP's for many years. Beginning in late 2018, the Division of Waste Minimization and Planning began to formulate a grant program whereby still-usable food nearing its expiration could be diverted from disposal at farms and retailers and transferred to non-profit food banks and kitchens. The grant would be offered to eligible non-profits to expand their capacity to collect, transport, store, and prepare the diverted food stock to those in need. The timing of the first grant solicitation was set for spring 2020.

With the advent of novel coronavirus COVID-19 and the subsequent increased need to feed and supply a large number of Pennsylvania residents affected by the pandemic, DEP implemented a

comprehensive overhaul of the newly created Food Recovery Infrastructure Grant (FRIG) Program in late April/early May to allow the rapid acceptance and review of applications. The efforts resulted in Governor Wolf's May 21, 2020 announcement of 145 grants to non-profit organizations totaling \$9.7 million. This program significantly increased the amount of fresh produce and dairy products food banks can stock and provide to those in need, eliminated unnecessary food waste, and prevented losses for the Commonwealth's farmers. The FRIG Program improved food security to residents.

Food Recovery Infrastructure Grants Awarded:

Year	2020
Grants Awarded	145
Dollars awarded, in millions	\$9.7

The intent of the FRIG program is to reduce, to the greatest extent practical, the amount of fresh and processed foodstuffs currently entering Pennsylvania's waste stream and feeding those in need. This grant program currently provides the necessary equipment for registered Pennsylvania non-profits to transport, store and prepare recovered fresh foods to feed those in need. The program also assists farmers from having to waste food and dairy products from being disposed. FRIG addresses ongoing food security issues by diverting food waste that would otherwise be disposed in landfills.

Going forward, DEP recommends reinstatement of pre-application conferences with Regional recycling staff. This will eliminate the submission of applications for ineligible projects or by ineligible entities. Pre-application conferences provide invaluable guidance to eligible applicants about what equipment is fundable under FRIG and increase DEP's ability to fund all eligible projects and eliminate or reduce the rejection of ineligible applicants and equipment. The conferences also assist with guidance and instruction on completion of a grant application through the Department of Community and Economic Development's Electronic Single Application (ESA) website. The program estimates more than 20 potential applicants never submitted in the last grant round due to their inability to navigate ESA and follow the detailed instructions.

The FRIG program needs to focus on the importance of nonprofit entities feeding more Pennsylvanians by diverting food that would otherwise be disposed in the Commonwealth. The organization must have an existing food recovery, utilization, and distribution program. The nonprofit will need to demonstrate that they are open and available year-round to feed all those in need and must provide their existing operation schedule. The nonprofit will also need to provide supporting documentation on the amounts of fresh and processed foods being recovered; where they are being recovered (retailers, wholesalers, agriculture organizations, farms, and cooperatives); and the number of residents being fed.

County Food Waste Composting/Digester Grant Program

DEP seeks to develop a grant program specifically to address the amount of food waste being disposed in Pennsylvania. This grant would focus on supporting the construction of food waste composting sites and the purchasing and placement of digester units by counties, municipalities, and other similar entities. The grant would target and divert the growing percentage of food waste currently generated from entering the waste stream.

In order for this grant program to be successful, municipal waste regulations regarding permitting will need to be addressed and modified. One recommendation is to create a PBR for acceptance and processing food waste, coupled with modification of the bonding and other restricting

requirements of existing municipal waste general permit WMGM025. The program proposes the exploration of a county and municipal food waste composting PBR similar to the current yard waste PBR. This PBR will allow immediate implementation of the proposed grant program. These modifications will address the current issues that counties and municipalities have in meeting the requirements in obtaining WMGM025. The permitting process needs to be streamlined in order for the expedited development of food waste composting sites and the purchase and placement of digesters across the Commonwealth.

The grant application would only be available to counties, municipalities, and similar entities. Applicants would need to commit to collect food waste from grocery stores, restaurants, and cafeterias to be eligible. The next phase of the food waste project would be the development of pilot projects for collecting food waste from residents. Applicants would need to demonstrate their proposed food waste recycling program and how the grant would develop and implement the collection, transportation, and processing of food waste. Items eligible for funding under this proposed grant program would include, but not be limited to site preparation of a food waste composting facility, including land development, paving, and fencing; and processing equipment including front-end loaders, windrow turners, trucks, containers and digesters. The ultimate goal of this grant program is for counties and municipalities to possess the ability to divert and properly manage food waste across the Commonwealth.

Work with the Energy Office to Develop a New Statutory Definition of Food Waste Recycling

In order to plan solid waste strategies, it is necessary to understand the waste stream generated by specific populations. To that end, DEP is undertaking a waste characterization study and recycling audit as discussed above. The purpose of the waste characterization study and recycling audit is to identify the amount and types of waste generated by rural, suburban, and urban areas within the Commonwealth, as well as the types and quantities of potentially available recyclable and compostable materials in the waste stream.

DEP and nationwide Waste Composition Studies, along with early results from the current waste composition study, identify food waste as a major portion of the municipal waste stream and there exists a need to identify, locate and evaluate existing facilities' ability and capacity to manage this component of the waste stream. Gathering of data regarding the management of food waste is a foundational element in DEP's strategy to handle various components of the municipal waste stream. DEP has directed the waste characterization study contractor to provide additional consulting services in support of the development of a *Commonwealth of Pennsylvania Food Waste-to-Energy Assessment* for the purpose of identifying the renewable energy generation potential from the diversion of institutional, commercial, and industrial (ICI) sources of food waste from the solid waste stream. This information will be used to evaluate the Commonwealth's current food capacity, areas in need of increased capacity and to prioritize future infrastructure investment.

County Yard Waste Composting Sites and Organics Management Plans

The modification of Act 101 should mandate that all counties are responsible for developing a county-wide yard waste composting program and the development of a county-wide Organics Management Plan. Counties will be required to support their residents and businesses through establishment of at least one facility for yard waste composting as part of their plan. These new requirements will ensure that all county residents and businesses have an accessible and convenient outlet for collected yard waste materials.

There would be different options available to counties to meet the yard waste composting operation mandate. The following are the options counties could select to meet those requirements:

- Counties must continually maintain and update a list of yard waste composting operations within the county. This list must meet the following criteria:
 - 1) Outline details of every municipality located within the county and their specific yard waste collection and processing practices.
 - 2) Identify all DEP-approved yard waste composting facilities, satellite drop-off locations and farms approved for land application of materials that are available to its residents and businesses (public, private and farming operations), including the name, address and hours of operation for all facilities.
 - 3) Identify all current mandated municipal yard waste curbside collection programs and those mandated programs complemented with drop-off locations, including the details of each specific mandatory operation program.
 - 4) The list must be maintained and updated quarterly and made available to DEP and the public.
 - 5) The yard waste operation program list must demonstrate adequate outlets exist for all residents and businesses.

AND

- Counties must operate their own yard waste composting facility and allow all residents to utilize their facility. This program would need to be complemented with satellite drop-off locations at the municipal level for accessibility to all residents and businesses. The county may also work cooperatively with municipal, private, and farming operations to provide accessible outlets for yard waste materials.

OR

- Counties must work in conjunction with municipal and private compost facilities, drop-off locations and farmland application locations to ensure that all county residents and businesses have the ability and access to recycle their yard waste material. Counties may be required to provide additional drop-off locations to meet the mandate.

The mandate to require counties to develop a county-wide Organics Management Plan addresses the ongoing need to capture and divert organic materials from being disposed in landfills or waste incinerators. The county will need to address this concern and reduce organic material from being disposed. The county plan must address the development and implementation for collection, transportation, and processing of organic materials through a yard waste composting educational and promotional program. Such a program is essential for success and ensures consistency of management of materials at all levels and stages. It will be the counties' responsibility for promoting their plan and ensuring all residents and businesses have an accessible outlet for yard waste material. The plan must also address the opportunities for cost savings and economic development.

These proposed modifications to Act 101 will require counties to be responsible for managing a successful county-wide organic program. Organic materials continue to be the greatest component in the municipal waste stream. These proposed changes will require that organic materials are managed as a valuable resource and will provide many benefits to the community. It will reduce the amount of organic materials currently being burned and illegally dumped.

Additionally, it will reduce litter, conserve natural resources, and remove organics from the waste stream. The implemented county-wide organic management plan will enhance and expand the organics management system by having short- and long-term goals.

Financial Incentives for Organics Collections at Grocery Stores, Restaurants and Cafeterias

The two obvious incentives that can be offered to businesses and institutions regarding food waste recycling are avoided collection/disposal costs and a “greener” image. Collection costs tend to be high for these entities because food waste requires a higher collection frequency—whether or not the container is full. If food waste is handled separately from other wastes generated at these facilities, a cost savings could be realized.

DEP recycling staff worked with a school facility in Berks County to assess its waste generation/collection with an eye toward cost reduction. It was found that collection of non-food waste could take place once per week, while a local composting facility (approximately 5 miles away) was willing to accept the food waste—thus lowering overall collection costs.

Approximately 10 years ago, DEP worked with the City of Philadelphia to establish a pilot program for restaurants to manage their food waste. A digester was centrally located within a group of establishments that separated their food waste and brought it for composting. That program continues to be operated successfully. DEP can utilize the success of this project to develop parameters and resources for locating and establishing additional projects.

Another way to facilitate cost avoidance would be through the implementation of a curbside organics collection program. This would be achieved by partnering with the county or the local municipality for the curbside collection of the organic materials. Doing so would require the creation of a grant for counties, municipalities, or similar entities for funding exclusively to collect and transport organic food waste material. Such a program has the potential of playing a huge role in diverting food waste from being disposed in the Commonwealth. The proposed grant would cover costs exclusively for food waste collection equipment. Items eligible for funding under this grant program would include box trucks with lifts, containers, dollies/pallet jacks, and education and training programs.

The need to educate grocery stores, restaurants and cafeterias will be a crucial component for the organics collection program to be successful. The organics collection education program would consist of providing specific details to these businesses and institutions on the preparation of how the organic materials need to be collected. Part of the education would also include how businesses can promote their participation in the food collection/composting program. The environmentally educated public is more apt to patronize a business that is concerned and active regarding waste issues over one that is not. The positive image a business gains from managing its food waste via composting can equate to more customers; more customers equals more revenue.

DEP-Initiated General Permits to Promote Food Waste Recycling

The following general permits need to be evaluated to determine the feasibility for modification and/or combination to facilitate ease of implementation and recognize the specific issues that arise in urban and suburban settings (i.e., proximity to homes, schools and public places; and nuisances that can arise such as odors, vectors, etc.). DEP should also initiate and develop permits that are globally useful to multiple entities and that take into consideration these issues. This task would be best coordinated by the reinstated Planning Section and the Organics Management “Czar.”

WMGM015 - Processing and beneficial use of wood and timber waste (i.e., tree stumps, limbs, clean wood, untreated and unpainted wood and pallets) and the leaf and yard waste as mulch and compost to compliment the mulch production.

WMGM016 - Processing and beneficial use of trees, tree stumps, limbs, clean pallets, untreated and unpainted scrap lumber, packing crates and brush.

WMGM017 - Processing and beneficial use of compost of manure, yard waste, source separated food scraps from food markets, grocery stores, food banks, food distribution centers, school cafeterias and institutions, source-separated newspaper, and source-separated corrugated paper (cardboard) as soil substitute, soil conditioner, fertilizer, mulch or soil amendment

WMGM025 - Composting and beneficial use of the following source-separated wastes: agricultural waste other than mortalities, butcher waste other than whole carcass, food processing waste, pre-consumer and post-consumer food residuals, yard waste, land clearing and grubbing material, untreated wood waste, gypsum wallboard, paper, cardboard, waxed cardboard, virgin paper mill sludge and spent mushroom substrate. The beneficial uses of the finished compost approved in this permit are for use, marketing or distribution as a soil conditioner, soil amendment, fertilizer, mulch or for erosion control. The finished compost is not considered a waste when it has satisfied the conditions of this permit and is ready for use, marketing or distribution as a soil conditioner, soil amendment, fertilizer, mulch or for erosion control.

WMGM027 - Processing of wood waste (clean and uncontaminated land clearing, grubbing and excavation waste, yard waste, and residual and municipal wood scrap) to produce mulch for landscaping purposes; leaf and yard waste, food processing residuals, and spent mushroom substrate (SMS) to produce compost; organic, non-organic residuals with a BTU value of at least 5,000 BTU/lb. for use as alternative fuels; compost, drinking water treatment plant sludge, waste gypsum, foundry sand and SMS with non-waste soils to produce topsoil for landscaping purposes; and clean, uncontaminated rock, stone, gravel, brick, block, concrete and used asphalt for use as a construction material at the processing facility only.

WMGM030 - Composting yard waste facilities between five acres and 15 acres.

WMGM042 - Processing by anaerobic digestion of animal manure generated on a farm to be blended with grease trap waste and pre-and-post consumer food waste from commercial and institutional establishments for beneficial use activity as follows:

- 1.) The methane gas produced by the anaerobic digestion as fuel, including in the production of electricity;
- 2.) The waste solids removed from the digester as animal bedding material at the farm; and
- 3.) The liquid waste and solids removed from the digester as a soil additive for agricultural purposes.

WMGM045 - Processing and beneficial use activities performed by facilities that, at any one time, do not exceed 5 acres and 6,000 cubic yards per acre of wastes as follows:

1.) Processing by mixing or blending, screening, and composting of:

- (a) source separated food processing waste;
- (b) source separated pre-and-post consumer food wastes;
- (c) yard waste;
- (d) unpainted and untreated wood waste;
- (e) source segregated paper and cardboard;
- (f) land clearing and grubbing waste; and
- (g) agricultural waste on an active or abandoned mine site approved by DEP as part of a mine reclamation permit or project.

2.) Beneficial use of the cured compost as a:

- (a) soil additive;
- (b) a mulch for landscaping purposes;
- (c) a fertilizer in normal farming operations or mine reclamation activities; or
- (d) in the production of a manufactured topsoil.

WMGM052 – general permit allows for the use of up to five manufactured Bio-Bins or approved equivalent for the storage of source separated food scraps, fruit, vegetables, breads, meats, fish, and other organic materials until transported to a permitted composting facility.

WMGM053 – general permit allows for the provision of unpackaged bakery, produce and dairy products that are diverted from disposal for beneficial use as a replacement for dry feed for livestock.

Best Management Practices and PBR (permit-by-rule) for Agricultural Operations

DEP has a limited ability to regulate farmers. The aversion of the agriculture community to DEP oversight has resulted in several missed opportunities. Most notably, the composting and digestion of yard waste, manures and food waste is not being implemented anywhere near the level it could be accomplished in the Commonwealth. A cooperative effort between DEP and the Department of Agriculture could create new economic opportunities for the agricultural and waste industries and reduce certain air emissions. Farmers also generate large volumes of plastics with limited options for recycling and costly disposal options.

Act 101 should be modified to require:

- DEP and Department of Agriculture to develop a PBR for on-farm organics management.
- Creation of best management practices for farmers to operate under the PBR.
- Create free organics management education programs for farmers.
- DEP tracking of locations, data, and capacity of these agricultural operations.
- Create co-ops for farmers to recycle the multitude of plastics generated by the agricultural industry.

Emerging Issues & Technologies

Cost for Municipalities

One of the gravest issues facing municipal recycling today is the rising cost of processing single-stream materials. As industry promoted single-stream as a cost-savings option via more efficient collection, and retooled sortation facilities (e.g. MRFs) to accept this combined stream, most municipal curbside programs converted to this system. As such, there are no private MRFs in Pennsylvania dedicated to commingled (dual stream) recycling and only a few small public facilities.

Due to contamination inherent in any program but especially attributable to single-stream, and depressed markets (COVID-19-related and more stringent Asian market standards), single-stream facilities have increased the fees they are charging to process materials by approximately 50%. In many cases, the cost to process recyclables is now greater than the cost to simply dispose of them. This puts pressure on decision-makers to find alternative program methodologies or to shut down programs altogether.

To revise programs to avoid these escalating costs usually entails increased educational efforts and additional/adapted equipment requirements. This also bears a cost which municipalities have historically relied upon DEP to offset (in whole or in part) through recycling grants.

Presently, the Recycling Fund is in a position where it cannot sustain the support necessary to alleviate these forces. Establishing a commingled/dual-stream processing facility for a county or a region would require millions of dollars. Even providing additional collection containers for households to further separate materials could cost tens of thousands of dollars per community—and there are over 1,000 curbside programs in Pennsylvania.

In summary, municipalities have few options to reduce the increasing cost of recycling other than suspending programs completely. DEP has no oversight of private processing facilities (the vast majority of processing capacity in the Commonwealth) and no financial ability at this time to leverage better pricing through the development of commingled/dual-stream competition. Private facilities could be regulated as a utility, thereby ensuring fair and transparent pricing; this would require action by the legislature.

Plastics

Recycling plastics poses a particular challenge going forward as an increasing amount of plastics enter the waste stream. Most plastics are designed for single-use and are petroleum-based, meaning they require considerable pre- and post-use energy for what is often seconds of use by the consumer. Furthermore, many plastic bottles are used for water, a commodity whose infrastructure already exists to be brought into homes and offices. The many different types of plastics make recycling difficult from community to community as end-markets are often unpredictable or non-existent. The many different types of plastics also require additional sorting; this can be particularly costly for those materials seen as contamination. As a result, many plastics end up in landfills or as litter, and in waterways either as bottles or microplastics.

New plastic management technologies are evolving that could assist in repurposing and recycling the vast array of plastics that have been introduced to the waste stream since the inception of Act 101. Listed below are the four primary technologies that have shown the most promise.

- *Depolymerization* turns mono plastic (like PET bottles) back into monomers, which can be re-polymerized into new PET-based products.

- *Solvolysis* (dissolution) is used to break down certain plastics like expanded polystyrene (EPS) into monomers with the aid of solvents.
- *Pyrolysis* converts mixed plastics into tar oil which can be cracked down and further refined for new plastics production.
- *Gasification* is able to process unsorted, uncleaned plastic waste and turn it into syngas, which can be used to build bigger building blocks for new polymers.

Solar Technology

There exist tremendous economic possibilities with continuing to grow the solar energy field. According to the Solar Energy Industries Association (SEIA), in 2020, the United States installed a record of 19.2 gigawatts (GW) of solar power capacity which brought to a total installed of 97.7 GW solar power capacity. Solar power in the United States offsets over 70 million metric tons of carbon dioxide every year, which is like planting almost 1.2 billion trees. Pennsylvania has installed a total solar power of 761.60 megawatts (MW) including 265.00 MW capacity installed in 2020 alone and projected growth of 1,350.28 MW over the next 5 years.

Solar panels, also known as photovoltaic panels or PV panels, are used to convert light from the sun to electricity. The National Renewable Energy Laboratory estimates the useful life of PV systems to be approximately 25 to 40 years depending on various factors such as environmental conditions. Therefore, it is expected that a surge of solar panel disposal will occur in the early 2030's when the first generation of installed solar panels reach their end-of-life. The International Renewable Energy Agency reported that global PV panel recycling or repurposing will provide an estimated stock of 78 million tons of raw materials and other valuable components by 2050. These recoverable materials have been valued at 15 billion dollars and could be used to produce 15 billion new PV modules. Ninety to ninety-seven percent of materials from decommissioned solar panels can be recycled or sold. Solar panel recycling will provide great opportunities for Pennsylvania to add skilled manufacturing jobs in a quickly evolving industry while simultaneously reducing its carbon footprint.

According to SEIA, by weight 80 percent of a typical PV panel is glass and aluminum which are common easily recyclable materials. Europe has demonstrated successful solar panel recycling through enacted laws and developed infrastructure. Some governments have begun developing module waste management and recycling mandates or guidance to promote recovery of valuable commodities such as silver, copper, and aluminum. The European Union added a PV category to its Waste Electrical and Electronic Equipment regulation in 2012, followed by requirements for depollution and material extraction. Countries such as the Republic of Korea, Australia, India, and Japan are developing requirements to ensure PV manufacturers have extended producer responsibilities, product stewardship, and mandatory recycling.

Domestically, Washington is the first state to require recycling of solar panels. Manufacturers are required to finance the takeback and recycling system at no cost to the owner of the PV module. California enacted regulations in 2021 that include PV modules in universal waste management. Solar panel wastes may include heavy metals such as silver, copper, lead, arsenic, cadmium, selenium that at certain levels may be classified as hazardous wastes. However, as universal waste, solar panels can be held on site up to a year, allowing them to be transported to recycling facilities in bulk, and reducing requirements for testing, labeling and paperwork. With EPA authorization in 2020, the change to California's hazardous waste program is federally enforceable.

As reported by SEIA, Pennsylvania has 395 solar related companies, 96 manufacturers, 201 installers/developers and 98 others, but it has only one drop-off location for a solar panel recycling company.

Recommendations & Conclusion

DEP has taken a comprehensive look at the current state of recycling and assessed available resources to prioritize initiatives in addressing climate change and economic recovery. An examination of Act 101 annual reporting data, coupled with early results from the DEP's waste composition study, revealed many opportunities on which DEP could capitalize.

The annual reporting data showed that the Department is not capturing all the recycling that is occurring in Pennsylvania and found clear underreporting in the leveling off and reductions of reporting in materials such as cardboard, plastics and certain metals. Capturing this data means more recycling data can be entered into the EPA WARM model and therefore, result in more quantifiable air emission reductions. Thus, a direct correlation to additional reductions in air emissions that could be captured exists and would further support the Commonwealth's climate change efforts.

Early results from the waste composition study show a significant portion of the current waste stream is organic. There exists tremendous opportunity to divert organics from landfills, and realize reductions in emissions, again in support of the Commonwealth's climate change efforts. Improving these efforts would also bolster the Commonwealth's ability to attract new business involved in recycling, thereby creating jobs, and decreasing emissions.

Further, the Department stresses that since the inception of the Recycling Fund, more than \$230 million has been diverted to other environmental programs and the General Fund. Along with failing to adjust the fee for inflation, which is still reflective of 1988 dollars, this diversion has severely limited the investment DEP can make in recycling infrastructure and, unfortunately, many of the recommendations in this report.

Also hindering recycling efforts and efficiency is the recent trend towards large single stream recycling facilities that have put many smaller, dual-stream and commingled facilities out of business. This transition has eliminated competition and, coupled with a downturn in the global marketplace, has created a situation where these fewer, bigger facilities can charge excessive prices resulting in the loss of some municipal recycling programs.

With adequate resources, DEP's recycling priorities would be:

- Fund projects to ensure food is used to feed Pennsylvanians in need rather than disposed.
- Fund projects to increase the diversion of organics to composting and anaerobic digestions.
- Create Research and Development grants to evaluate and invest in emerging technologies.
- Fund regional public Material Recovery Facilities to create competition and increase stability in the cost of processing recyclables.
- Create new General Permits for a variety of organic materials.
- Reinstigate a Waste Planning Section to evaluate new technologies, product evaluations and the consumption of recyclable materials in Pennsylvania.

- Oversee the development of a comprehensive education program to improve the quality of materials collected.
- Expand access to recycling through convenience centers. Ensure all Pennsylvanians have convenient access to all recycling options.

Additionally, the following changes would be recommended:

Statutory

- Prohibit certain materials from disposal.
- Require communities to collect all eight mandated materials.
- Require all business to implement recycling programs.
- Require increased recycling and recovery at landfills, resources recovery facilities and transfer stations.
- Increase the recycling fee to be consistent with current economics and provide real limitations on its use.
- Increase frequency of education efforts required by local governments.
- Implement phased-in organic collection requirements for certain municipalities.
- Clearly delineate recycling from resource recovery to address the inconsistencies between Act 101 and recently passed HB1810.

Policy

- Set aside funding for public Material Recovery Facilities.
- Provide enforcement/compliance assistance guidance for communities to gain compliance among commercial entities operating within their jurisdictions.
- Create guidance on commercial and residential waste reduction strategies.
- Increase focus on reuse through existing businesses and provide grants for their expansion.
- Refocus on the hierarchy of Reduce – Reuse – Recycle.
- Work with the Green Government Council to prioritize recycling among all state agencies.

Regulatory

- Clarify County Coordinator requirements.
- Eliminate the unnecessary air pollution and groundwater contamination associated with open burning waste.
- Expand county planning requirements to encompass more coordination of their respective recycling programs.
- Expand public participation in the county planning process.
- Allow counties to plan for the management of items like waste tire, leaf waste, HHW etc.
- Include specific reporting requirements for waste haulers to ensure recycling is properly reported.
- Clarify certification and decertification requirements for Host Municipal inspectors.
- Clarify general HHW requirements for ongoing programs.
- Update county and municipal scope and authority to implement recycling programs.

In closing, recycling is the most recognized environmental program in Pennsylvania and contributes significantly to environmental protection and climate initiatives, while simultaneously strengthening the economy and employment. As such, the Commonwealth's residents and

recycling industries would be well-served by the implementation of the proposed changes outlined in this program review. However, the Department understands that not all the changes would be implemented, but those where consensus could be reached would still provide considerable positive environmental and economic benefits.