

THE ECONOMIC IMPACTS OF THE MUNICIPAL WASTE COLLECTION, TRANSPORTATION, RECYCLING, AND DISPOSAL INDUSTRY IN PENNSYLVANIA



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FOREWORD BY PENNSYLVANIA WASTE INDUSTRIES ASSOCIATION (PWIA)

This study is a snapshot of **the economic impact of the municipal waste collection, transportation, recycling, and disposal industry in Pennsylvania.**

The bottom-line conclusion of the research conducted by Econsult Solutions, Inc., a Philadelphia-based economic consulting firm, is that **the municipal waste industry in Pennsylvania produces a total economic impact of more than \$4.2 billion a year and supports more than 26,000 jobs.**

This is the third such study the **Pennsylvania Waste Industries Association (PWIA)** has commissioned. Each study, including this one—which encompasses an economically challenging time period in our nation’s economic history—validates the growth and the value and importance of the industry’s contribution to the Pennsylvania economy.

PWIA specifically represents the private-sector members of the industry and is the Pennsylvania state chapter of the National Waste & Recycling Association.

The numbers in this study were determined using accepted economic methodology, based on official state and national data and information collected in a survey of Pennsylvania landfill operators, haulers, and recyclers.

Most people put out their trash and recycling bins and think no more about them once they’ve been emptied. Most neither understand nor appreciate the magnitude of what lies behind this seemingly simple service.

The traditional handling of solid waste and the rapidly-growing commitment to recycling (Pennsylvania’s statewide recovery rate of recyclables from the waste stream is 35 percent) combine as complementary elements that serve and benefit all Pennsylvanians.

The municipal waste industry collects, hauls, and disposes of 8.6 million tons of Pennsylvania municipal solid waste annually. Overall, it operates 45 municipal waste landfills, five construction demolition landfills, three residual waste landfills, and six resource recovery facilities, all dealing with non-hazardous materials.

The industry also serves as the “front end” of **recycling** in Pennsylvania—collecting, hauling, separating, and processing to varying degrees the recyclables that become the feedstock for re-use and re-manufacture into new products. Recycling is the fastest-growing component of the waste industry.



The amount of materials recycled in Pennsylvania grew from 4.8 million tons in 2006 to 5.85 million tons in 2011, an increase of 20 percent. The municipal waste industry has invested heavily in single-stream processing technology that makes recycling more attractive and effective. About 30 percent of Pennsylvania's recycled commodities are exported, bringing new money into the state economy.

The municipal waste industry also is a leader in developing and delivering "**green energy**" from landfill gas, helping to make Pennsylvania the No. 2 state in the nation for operational landfill gas-to-energy projects.

About half of the industry's \$4.2 billion statewide annual economic contribution is in the form of direct annual operating expenditures and employment within the municipal waste industry—roughly \$2.3 billion. (The industry directly provides jobs to about 12,000 people at an average wage of \$55,000 per year.)

The other half of the economic contribution occurs in the form of indirect and induced impacts—ripple economic activity and employment "across a multitude of industries" that do business with and provide services to the municipal waste industry.

In addition, **the municipal waste industry annually generates about \$250 million in various taxes and fees to state and local governments**, including about \$80 million a year in state disposal, recycling, and environmental fees and about \$60 million a year in payments to municipalities that host disposal facilities. And in just the period of 2010 to 2012, the municipal waste industry invested \$400 million in capital improvements.

Through collection, recycling, and disposal, the municipal waste industry is a positive contributor to the Commonwealth of Pennsylvania and to local communities. It represents a considerable array of job opportunities for local residents and contract opportunities for local vendors. It is a major source of tax and fee revenue to state and local governments. And the innovations that have come from the private sector of this industry have helped establish Pennsylvania as a national leader in environmental safety, recycling growth, and the production of green energy.

1.0 INTRODUCTION AND OVERVIEW

1.1 PURPOSE OF REPORT

Residents and businesses in localities throughout the Commonwealth of Pennsylvania routinely intersect with the **municipal waste industry**. However, the statewide economic impacts that result from the collection, transportation, recycling, and disposal of municipal waste are not often fully appreciated. The purpose of this report is to identify, articulate, and quantify these economic impacts, in order to inform policy discussions concerning this important statewide industry.

This report was sponsored by the **Pennsylvania Waste Industry Association (PWIA)**, a chapter of the National Waste & Recycling Association. It was produced by Econsult Solutions, Inc., a Philadelphia-based economic consulting firm that has conducted economic impact studies for a variety of industries within the Commonwealth. This report is similar in scope to a 2007 report conducted by Econsult Corporation for PWIA,¹ and represents an update of that report.

1.2 DIRECT FOOTPRINT

The municipal waste industry is **a major bloc of economic activity within the Commonwealth**. By itself, it represents a significant level of firm revenues, operating expenditures, employment, and wages, as well as a large amount of capital investments (see Section 2). These direct contributions are all the more important during a time period in which the Commonwealth and the rest of the US has experienced economic uncertainty, high unemployment, and slack construction demand.

1.3 POSITIVE CONTRIBUTIONS

In the course of its operations, the municipal waste industry is a positive contributor to the Commonwealth on three fronts. First, it has led the Commonwealth's increase in **recycling** activity over the past several years (see Section 3). Second, it has led the Commonwealth's increase in **landfill gas-to-energy production** over the past several years (see Section 4). These two areas are of increasing importance within the overall industry, and not only produce positive environmental outcomes but meaningful economic outcomes as well.

Third, individual members of the municipal waste industry have continued to invest – financially and relationally – in their **local communities** over the past several years, even through an economically challenging time period (see Section 5). Hence, in addition to representing jobs and economic activity throughout the Commonwealth, members of the municipal waste industry make positive civic contributions at the local level.

¹ "The Economic Impacts of the Municipal Waste Collection, Transportation, and Disposal Industry in Pennsylvania," Econsult Corporation (2007).

1.4 ECONOMIC AND FISCAL IMPACT

The direct economic activity of the municipal waste industry in the Commonwealth in turn produces spillover economic impacts in two ways:

1. First, operating expenditures by the municipal waste industry in turn support a wide range of support industries, creating additional economic demand and supporting additional employment. These are referred to as “indirect impacts.”
2. Second, wages and salaries earned by municipal waste industry employees are in turn spent within local economies, creating additional rounds of economic activity and supporting more employment. These are referred to as “induced impacts.”

This notion of spillover economic impacts is well-established,² as are the methodological approaches used in this report to calculate the composition and scale of economic impacts resulting from the municipal waste industry in the Commonwealth.³

The economic activities represented by the municipal waste industry in the Commonwealth and by the spillover impacts that result from it in turn expand various Commonwealth tax bases.⁴ Thus, in addition to directly paying Commonwealth taxes, as well as a variety of fees to the Commonwealth and to localities within the Commonwealth, the municipal waste industry also generates **spillover economic activity** that grows various Commonwealth tax bases and produces even more **Commonwealth tax revenues** (see Section 6).

Throughout the report, economic and fiscal impacts are estimated for the Commonwealth as a whole, as well as (where possible) for individual regions within the Commonwealth, as defined by the Pennsylvania Department of Environmental Protection (DEP) (see Figure 1.1).

1.5 RESEARCH APPROACH

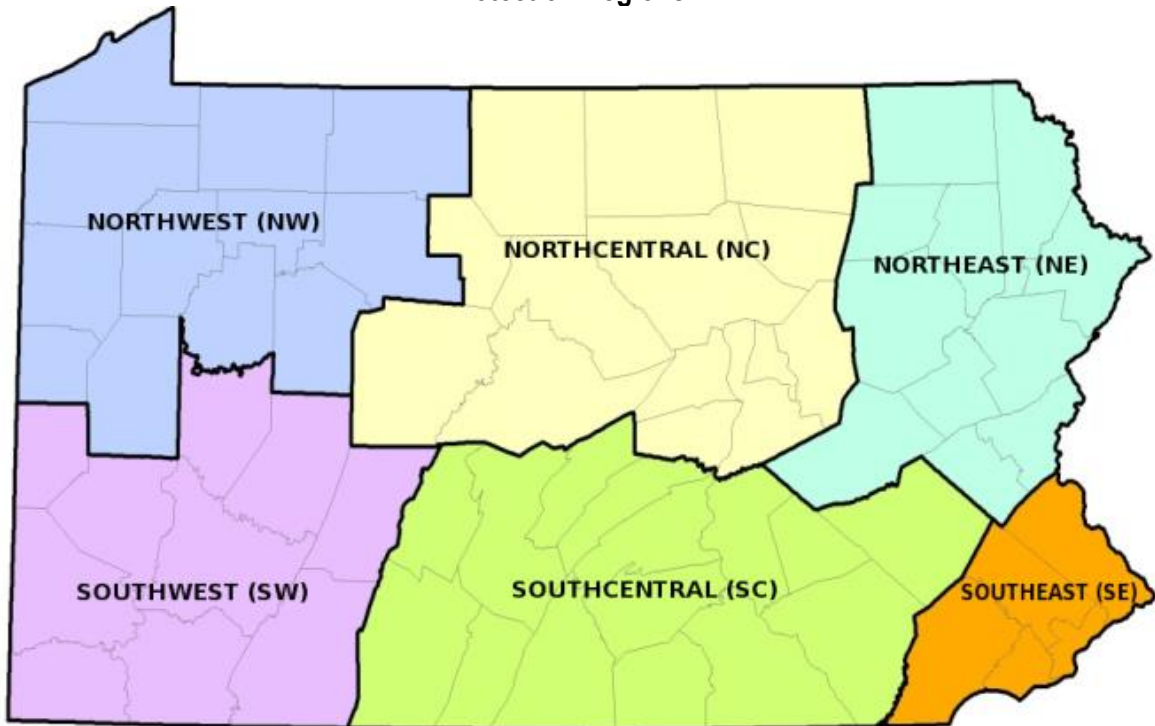
There were primary and secondary aspects to the research involved in the production of this report. As described throughout the report, state and national data sets were used to understand the composition and scale of the municipal waste industry in the Commonwealth. Also, a survey of landfill operators, haulers, and recyclers was conducted through PWIA (see Table 1.1), yielding site-level data points to validate the secondary data and economic analysis and to inform supplementary commentary.

² See Appendix A for additional detail on economic impact modeling theory.

³ See Appendix A.3 for additional detail on Econsult Solutions, Inc.'s economic impact methodology.

⁴ See Appendix A.4 for additional detail on Econsult Solutions, Inc.'s fiscal impact methodology.

Figure 1.1 – Geographic Boundaries of Commonwealth of Pennsylvania Department of Environmental Protection Regions⁵



Source: Pennsylvania Department of Environmental Protection (2013)

Table 1.1 – Number of Survey Responses from Different Types of Establishments within the Municipal Waste Industry in the Commonwealth of Pennsylvania⁶

Survey Respondent Type	# Respondents
Landfills	25
Haulers	21
Recyclers	7
Total	53

Source: Econsult Solutions, Inc. (2013)

⁵ See Appendix B for the county composition of Pennsylvania Department of Environmental Protection regions.

⁶ Different survey types were sent to landfills, haulers, and recyclers. For the 2007 report, one survey type was used for all respondents.

2.0 MUNICIPAL WASTE COLLECTION, TRANSPORTATION, RECYCLING, AND DISPOSAL INDUSTRY

2.1 SECTION OVERVIEW

Determining the direct footprint of the municipal waste industry in the Commonwealth requires first defining what constitutes municipal waste industry activity, and then estimating the direct expenditures, employment, and earnings represented by that activity. Direct impact is also generated from the capital expenditures made by individual members of the municipal waste industry in the Commonwealth.

2.2 DEFINING THE MUNICIPAL WASTE INDUSTRY

At its core, the municipal waste industry includes such functions as collection, transportation, recycling, and disposal, and as such encompasses multiple six-digit NAICS codes⁷ within the two-digit industry code of 56, “Administrative and Support and Waste Management and Remediation Services” (see Table 2.1).⁸

Table 2.1 – Six-Digit NAICS Codes Considered to be Included in the Municipal Waste Industry for Purposes of This Report

NAICS	NAICS Name
562111	Solid Waste Collection
562119	Other Waste Collection
562212	Solid Waste Landfill
562219	Other Nonhazardous Waste Treatment and Disposal
562920	Materials Recovery Facilities

Source: US Office of Management and Budget (2013), Econsult Solutions, Inc. (2013)

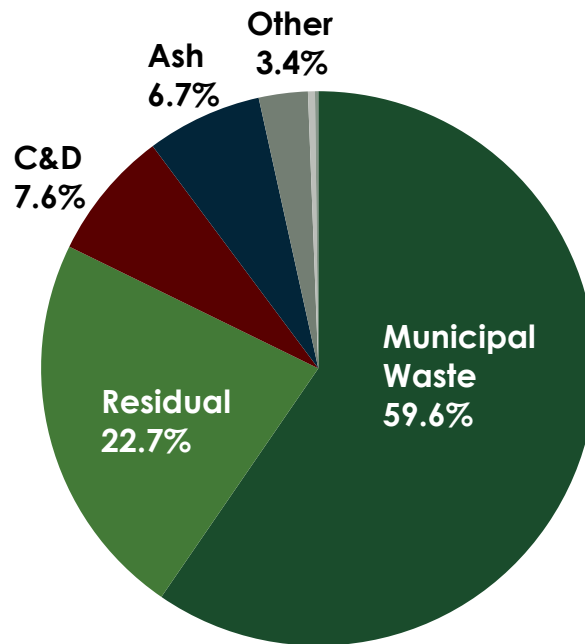
⁷ North American Industry Classification System (NAICS) Codes are the standard way of organizing economic activity by industry.

⁸ Collecting and hauling recyclable materials falls within NAICS 562111. Excluded from this analysis were such functions as hazardous waste collection, solid waste combustion and incineration, and remediation services. See Appendix C for additional detail on the NAICS codes considered to be included in the municipal waste industry.

2.3 COMPOSITION OF WASTE COLLECTION ACTIVITY WITHIN THE COMMONWEALTH

Currently operating within the Commonwealth are 45 municipal waste landfills, five construction and demolition waste landfills, three residual waste landfills, and six waste-to-energy and resource recovery facilities.⁹ These facilities process a variety of nonhazardous waste. For instance, in addition to municipal waste, the standard image of waste, Pennsylvania landfills also receive residual waste, sewage sludge, infectious waste, construction materials and demolition debris, ash residuals and asbestos (see Figure 2.1). The waste industry provides a critical service by safely and properly disposing of these materials. According to the DEP, 8.6 million tons of municipal waste was collected in the Commonwealth in 2012.¹⁰

Figure 2.1 – Distribution of Waste Collected in the Commonwealth of Pennsylvania in 2012¹¹



Source: Pennsylvania Department of Environmental Protection (2013), Econsult Solutions, Inc. (2013)

⁹ According to the DEP, as of September 2013.

¹⁰ Materials deposited in municipal landfills include not just municipal items, but residual, sewage, disinfected medical, construction and demolition (C&D), and asbestos wastes as well. See Appendix D for municipal waste generated from and collected in the Commonwealth by region. Pennsylvania facilities also provide safe and effective regional disposal services.

¹¹ "Other" includes sewage sludge (2.9 percent), disinfected medical (0.4 percent) and asbestos (0.2 percent).

2.4 ANNUAL OPERATIONS

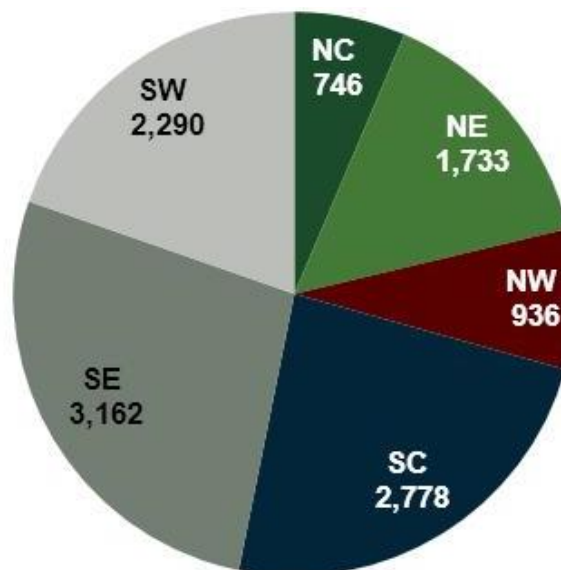
Based on statewide data as provided by IMPLAN, it is estimated that the municipal waste industry in the Commonwealth represents about **\$2.3 billion in annual operating expenditures** and **directly employs about 12,000 people** throughout the Commonwealth, who make on average **about \$55,000 per year** (see Table 2.2 and Figure 2.2).¹² This is a significant bloc of mostly well-paying jobs within the Commonwealth, and is particularly welcomed at a time of high unemployment and stagnant wage growth.

Table 2.2 – Direct Expenditures, Employment, and Earnings Represented by the Municipal Waste Industry in the Commonwealth of Pennsylvania

Expenditures	Employment	Labor Income ¹³	Average Annual Salary
\$2.27 Billion	11,640 Jobs	\$680 Million	\$55,000

Source: IMPLAN (2012), Econsult Solutions, Inc. (2013)

Figure 2.2 – Distribution of Direct Employment Represented by the Municipal Waste Industry in the Commonwealth of Pennsylvania, by Region



Source: IMPLAN (2012), Econsult Solutions, Inc. (2013)

¹² These estimates represent statewide totals for the municipal waste industry, as defined by the sub-industries listed earlier in this section. See Appendix E for additional detail on direct expenditures, employment, and earnings represented by the municipal waste industry in the Commonwealth by region.

¹³ Throughout the report, “labor income” is the sum of employee compensation and sole proprietor income.

2.5 CAPITAL EXPENDITURES

Additionally, between 2010 and 2012, individual members of the municipal waste industry made at least¹⁴ **an aggregate \$400 million in capital expenditures** (see Table 2.3 and Figure 2.3). These capital investments represent direct expenditures by the municipal waste industry within the Commonwealth over and above their expenditures for operating activities. These figures are all the more impressive because they took place during a time period of significant economic distress due to the recent global recession. Thus, in addition to representing expansions and modernizations for the municipal waste industry, these capital investments also stimulated the Commonwealth economy and supported construction and other jobs, which was particularly useful at a time of high unemployment and slack construction demand.

Table 2.3 – Aggregate Amount of Capital Expenditures Made from 2010 to 2012 by Survey Respondents Representing Individual Members of the Municipal Waste Industry within the Commonwealth of Pennsylvania

Survey Respondent Type	# Respondents That Reported Capital Expenditures	Amount
Landfills	23	\$275.8 Million
Haulers	19	\$121.9 Million
Recyclers	5	\$2.3 Million
Total for all Survey Respondents	46	\$400.0 Million

Source: Econsult Solutions, Inc. (2013)

¹⁴ Because capital expenditure levels are not necessarily uniform across establishments, these figures were not extrapolated upwards to account for non-respondents. Since it is likely that non-respondents did in fact make some capital investments, not extrapolating (i.e. assuming that non-respondents made no capital investments) yields aggregate estimates that are conservatively low.

Figure 2.3 – Illustrative Capital Expenditures Made by Individual Members of the Municipal Waste Industry within the Commonwealth of Pennsylvania

GROWS Landfill in Morrisville, PA is quickly becoming a model for clean energy development through beneficial partnerships. From 2010- 2012 it made over \$80 million in capital improvements. It is one of two landfills that supplies landfill methane gas to Exelon’s Fairless Hills Steam Generating Station, which is the second largest landfill gas power plant in the U.S.¹⁵

In 2008, Exelon invested \$20 million to place 16,000 solar panels on Waste Management’s land adjacent to the landfill. The project, which includes a 20 year multi-partner contract, can power 350-400 homes a year.¹⁶

Green Tree Landfill in Kersey, PA made \$21 million in capital improvements from 2010-2012. Its partnerships have led to one of the largest landfill gas energy projects in the country.

In 2007, Green Tree won the EPA’s Landfill Methane Outreach Program’s “2007 Project of the Year.”¹⁷

A processing facility was developed to turn landfill gas into natural gas that has the ability to generate power for 45,000 homes.¹⁸

2.6 POSITIVE CONTRIBUTIONS

Before considering the total economic and fiscal impact resulting from the operating expenditures and capital investments of the municipal waste industry in Pennsylvania (see Section 6), it is useful to acknowledge that the municipal waste industry’s activities produce three sets of positive contributions for the Commonwealth. First, the municipal waste industry leads on recycling efforts (see Section 3). Second, it leads on energy generation innovations (see Section 4). Third, it invests in local communities (see Section 5).

¹⁵ “Fairless Hills Steam Generating Station,” Exelon Corporation.

¹⁶ Mettler, Diane, “Going PV in Pennsylvania,” *Ener G- Alternative Sources Magazine* (September/October 2008).

¹⁷ AEC Daily, “EMCOR Group, Inc. Project Receives Environmental Protection Agency ‘2007 Project of the Year’ Award” (January 15, 2008).

¹⁸ “Veolia Plans to Capture Clean-Burning Natural Gas from its Greentree Landfill,” *Waste Business Journal* (January 12, 2007).

3.0 RECYCLING

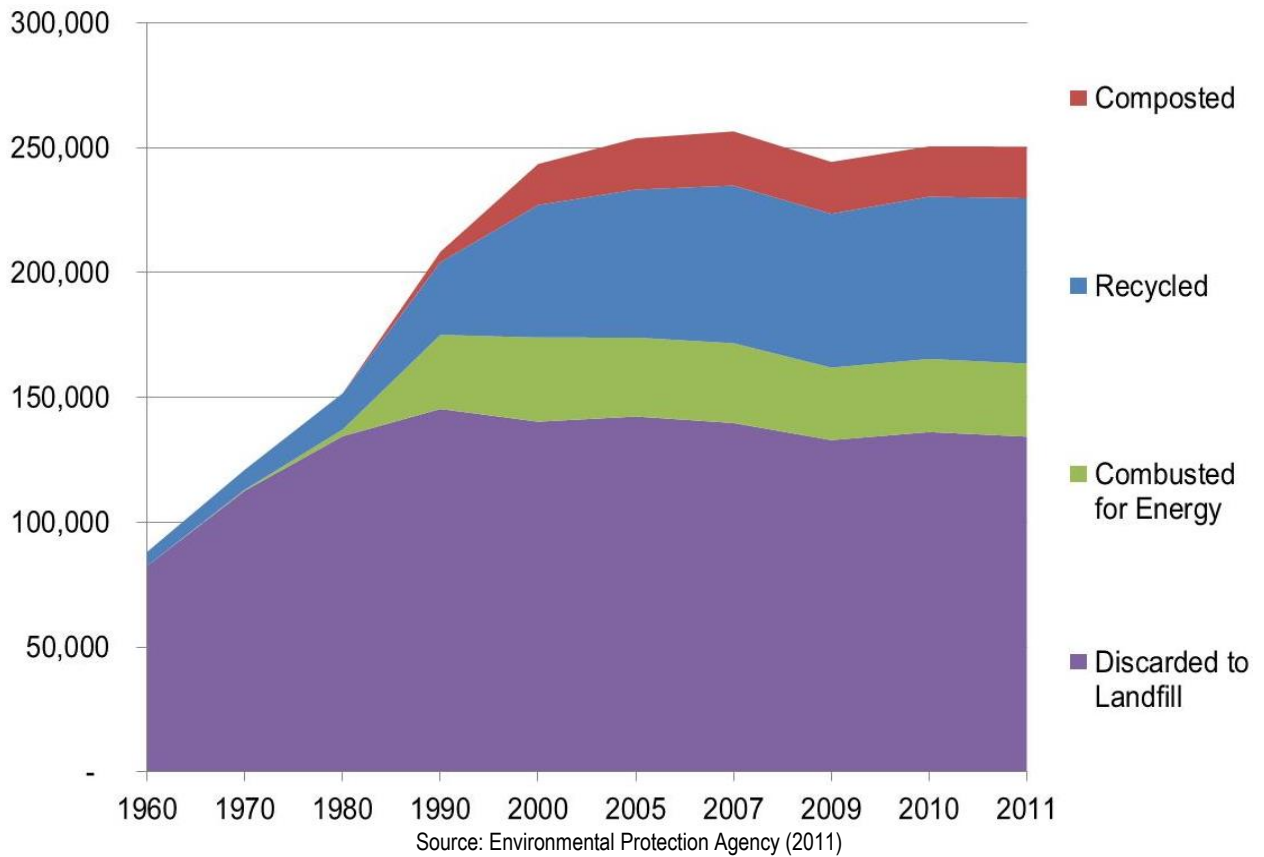
3.1 SECTION OVERVIEW

The municipal waste industry has led the Commonwealth in making significant progress in the area of **recycling**. Recycling has the dual benefit of reducing capacity pressure on landfills and of returning inputs back into the supply chain as raw materials. As the US as a whole has seen only a limited increase in recycling since about 2000, the Commonwealth, thanks to the investments and innovations made by individual members of the municipal waste industry in the Commonwealth, has seen continued and significant increases in recycling.

3.2 NATIONAL TRENDS

Recycling had been a rapidly growing component of the waste industry nationally until about 2000. The proportion of materials recovered from the national waste stream has more than doubled from 16.0 percent in 1990 to 28.6 percent in 2000 to 34.1 percent in 2011, and as a result, even as waste generation continues to increase, the level of discarded amounts has stayed flat for over 20 years (see Figure 3.1).

Figure 3.1 – Waste Generated and Recovered in the US, by ‘000 Tons

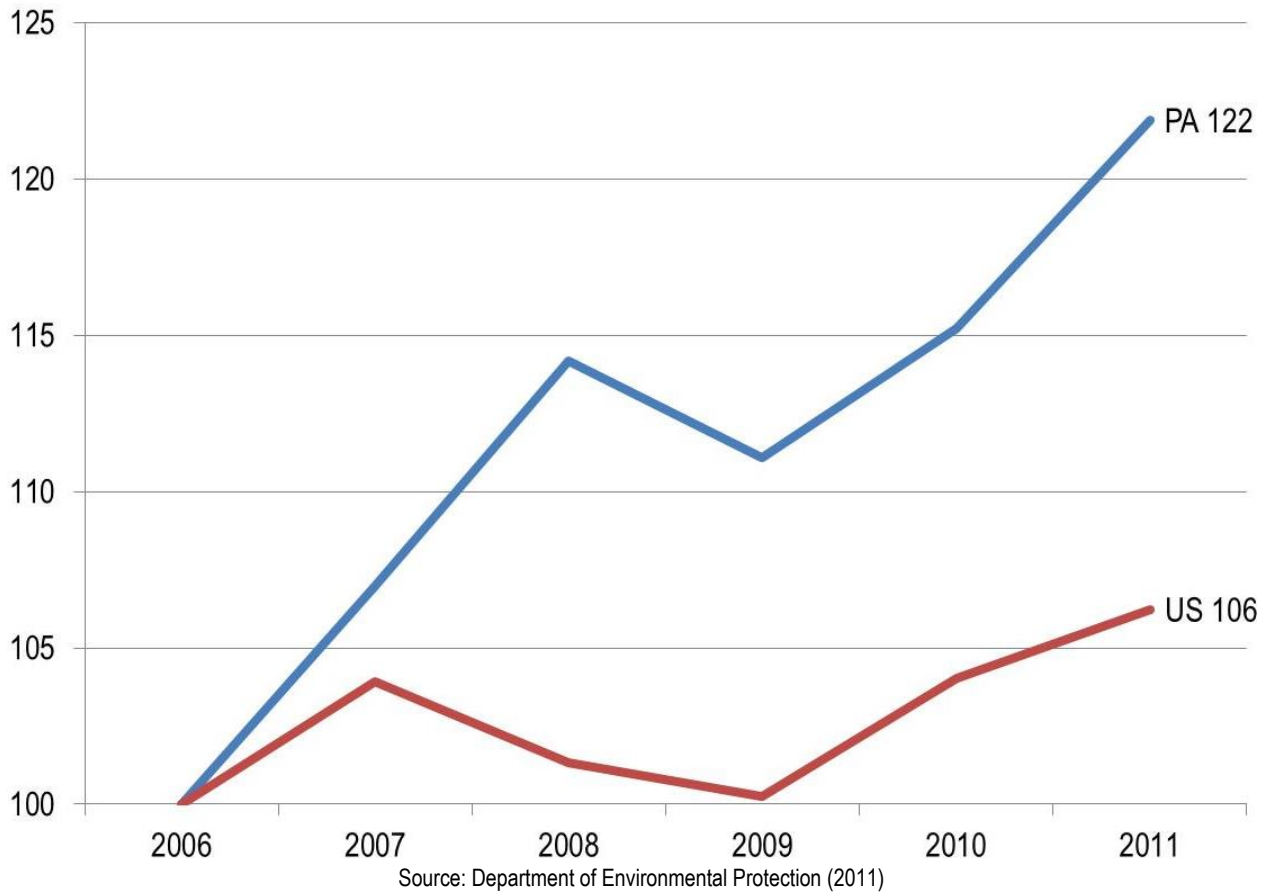


3.3 COMMONWEALTH TRENDS

Part of the upward national trend in the increase in recycling rates was made possible by the efforts of state governments, including the Commonwealth. In 1988, the Commonwealth mandated recycling in the more densely populated municipalities, including with that mandate the implementation of curbside recycling. Currently, over 90 percent of the population in the Commonwealth has residential access to recycling.

More recently, private investment and advancement in the recycling industry has led to an increase in the amount of materials recycled in Pennsylvania by 22 percent, from 4.80 million tons in 2006 to 5.85 million tons in 2011, at a time when recycling amounts increased by only 6 percent in the US as a whole (see Figure 3.2). In other words, **the recent growth in amount recycling within the Commonwealth is three-and-a-half times that of the US as a whole.**

Figure 3.2 – Waste Recycled in the Commonwealth of Pennsylvania and in the US (Indexed: 2006 = 100)



In fact, due in large part to efforts by the municipal waste industry to make recycling easier for consumers, the increase in recycling activity among residents of the Commonwealth is even greater. Among “Act 101” materials (i.e. those covered under the Municipal Waste Planning, Recycling and Waste Reduction Act of 1988, which mandates recycling in Pennsylvania’s larger municipalities, requires counties to develop municipal waste management plans, and provides for grants to offset expenses), such as paper, plastics, cans, and glass, the increase during this time period was 25 percent (see Table 3.1).

Table 3.1 – Tonnage for All Recyclable Materials, All Act 101 Recyclable Materials, and Selected Categories of Materials in the Commonwealth of Pennsylvania

Material Type	2006	2011	% Change
Paper ¹⁹	608,961	412,498	-32.3%
Plastic ²⁰	42,700	61,523	+44.1%
Glass ²¹	58,691	33,879	-42.3%
Act 101 Materials	1,835,942	2,300,562	+25.3%
All Items	4,803,661	5,854,882	+21.9%

Source: Department of Environmental Protection (2011)

This increase in tonnage of recycling materials is made all the more impressive by the fact that that increase came at a time in which a number of broader trends were resulting in a significant decline in recyclable materials. For example, tonnage of recycled glass was down by over 40 percent during this time period, reflecting a shift in packaging from glass to plastic. Meanwhile, lower newspaper circulation and higher readership in digital versus paper formats had led to a decline in paper recycled of over 30 percent.

3.4 COMMONWEALTH INNOVATIONS

Innovations in the recycling industry have had a profound influence on supply chain management. In 2011 and again in 2013, PWIA hosted the Pennsylvania Recycling Industries Congress, highlighting recent changes in recycling practices designed to capture new materials, such as turning scrap drywall into animal bedding and paper into insulation.

The industry-led changeover to **single-stream or commingled recycling** has saved the industry and the supply chain substantial costs, despite the fact that the capital costs of single-stream are 60 percent that of multi-stream alternatives. Industry investment in **Materials Recovery Facilities (MRFs)** has resulted in significant increases in processing capacity, commensurate with the significant increase in recycling that results upon implementation of single-stream recycling programs, and the elimination of separation requirements has made more efficient use of truck carrying volume, reducing costs in that area as well.²²

¹⁹ "Paper" = magazines, newsprint, mixed papers, office papers, computer paper, and phone books.

²⁰ "Plastic" = plastics symbol #1 or polyethylene terephthalate (PET) (e.g. soft-drink bottles), plastics symbol #2 or high density polyethylene (HDPE) (e.g. milk jugs), plastics symbol #3 or polyvinyl chloride (PVC) (e.g. shampoo bottles), plastics symbol #4 or low density polyethylene (LDPE) (e.g. plastic bags), plastics symbol #5 or polypropylene (PP) (e.g. ketchup bottles), plastics symbol #6 or polystyrene (PS) (e.g. disposable plates), mixed plastic, film plastic, and other plastic.

²¹ "Glass" = clear glass, mixed glass, green glass, brown glass, plate glass, and other glass.

²² "Dual Stream vs. Single Stream Collection and Processing of Recyclables," Columbia University Earth Engineering Center (July 2011).

Furthermore, by making recycling easier and more attractive for consumers, localities where single-stream recycling has been implemented have seen almost immediate volume increases of up to 30 percent.²³ Statewide, **single-stream recycling increased by almost 150 percent from 2006 and 2011, and now represents 43 percent of all recycled Act 101 materials by tonnage, up from 22 percent just a few years prior** (see Table 3.2).

Table 3.2 – Single-Stream Recycling Tonnage vs. Tonnage for All Act 101 Recyclable Materials in the Commonwealth of Pennsylvania

	2006	2011	% Change
Single-Stream ²⁴	405,003	999,512	+146.8%
Act 101 Materials Less Single-Stream	1,430,939	1,301,050	-9.1%
All Act 101 Materials	1,835,942	2,300,562	+25.3%
% Single-Stream	22.1%	43.4%	+96.4%

Source: Department of Environmental Protection (2011)

In 2011, Waste Management opened a \$20 million, 60,000 square foot MRF in Philadelphia. It is the largest facility of its kind in the region. In addition to the environmental benefits from the increased capacity for single stream recycling, the building itself was constructed with recycled materials, construction debris was recycled, advanced storm water management controls were installed, and the building was certified LEED Silver.²⁵

Rewards programs have also been implemented to increase participation. For example, RecycleBank and Allied Waste Services' program for its "BuckMont" division offers discounts to residents and promotions at local businesses based on the amount of material recycled.²⁶

Finally, the waste industry has introduced **new technologies to recycle many complex materials** beyond residential paper, plastics, metal, and glass. One such example has been in response to Marcellus Shale drilling. WellSpring Environment Services, LLC has come up with a way to recycle high-density well pad liners into new, marketable products. The company estimates that this will avoid disposal of 20 million pounds of Marcellus Shale well pad liners at landfills every year. This first-of-its-kind recycling operation is also expected to create 80 new jobs and generate an estimated \$1 million year in-state and local tax revenues.²⁷ Another

²³ "Our Big Blue Bin: PA's Recycling Industry Grows into Green Force," Keystone Edge (April 21, 2011).

²⁴ Includes all items designated as "single-stream" or "commingled."

²⁵ "Waste Management Celebrates Grand Opening of Philadelphia Material Recovery Facility," Waste Management (2011).

²⁶ "RecycleBank, Allied offer Recycling Rewards to Pa. Area," Waste & Recycling News (August 18, 2010).

²⁷ "PA RMC Facilitates \$4M New Investment, 80 New Job in Plastic Liner Recycling from Shale Gas," Pennsylvania Recycling Markets Center (July 30, 2012).

innovation is from USA Gypsum, which will turn gypsum drywall into a lawn and garden soil amendment and animal bedding.²⁸

3.5 SUPPORTING ADDITIONAL ECONOMIC ACTIVITY

According to the Pennsylvania Recycling Markets Center, the Commonwealth has over 2,200 operations involved in the collection and processing of recyclables, about 500 manufacturers and demand-side users of recycled materials, and over 1,000 operations involved in reuse and remanufacturing.²⁹ Part of the drive for innovation is consumers' desire to buy recycled material. **Consumer demand for products made of recycled content** has made certain recycled material an asset and recycling a marketing tool for companies.³⁰

The recycling industry also creates many **supplemental and downstream economic impacts**. For instance, the scrap metal recycling industry is one of the nation's largest exporters by value and a significant generator of economic activity in Pennsylvania. Roughly 30 percent of Pennsylvania's scrap recycling commodities are exported, bringing new money into the Commonwealth economy, supporting jobs, and can be a great source of expansion for the industry.³¹

A recent report compiled by the Northeast Recycling Council (NERC) segments **recycling-complementary industries** into two categories: "Recycling Reliant Industries" and "Reuse and Remanufacturing." The first group is made up of sectors whose production cycle is dependent on material inputs generated from the recycling process. The latter group consists of industries that purchase sorted material and resell it immediately or after making minor alterations. The waste industry is a prominent part of and contributor to these sub-industries.

²⁸ "Drywall Recycling Benefits Lawns and Gardens," Pennsylvania Recycling Markets Center (March 28, 2011).

²⁹ "Certification of Recycled Content Will Help PA Manufacturers Promote Products Made from Recycled Materials," Pennsylvania Recycling Markets Center (July 19, 2011).

³⁰ Ibid.

³¹ "The US Scrap Recycling Industry Promotes Pennsylvania Exports," Institute of Scrap Recycling Industries, Inc. (July 2013).

4.0 ENERGY GENERATION

4.1 SECTION OVERVIEW

The municipal waste industry has led the Commonwealth in making significant progress in the area of **energy generation**. Landfill gas-to-energy (LFG) extraction has produced many and various benefits to the consumer, community, and environment. End users of LFG enjoy energy costs discounted to that of fossil fuel prices or predictable, locked-in long term fuel costs. LFG also facilitates greater job retention, and the build-up of new plants using LFG technology has created significant new employment opportunities, both in construction and long-term plant operations.

In addition to direct economic benefits, LFG also has several environmental benefits through the reduction of emissions and greenhouse gases. LFG-fueled electricity in PA has resulted in the following emission reduction equivalents:³²

- 7.2 million metric tons of carbon dioxide equivalents per year;
- 341,000 tons of methane per year; and
- 809,000 tons of carbon dioxide a year.

4.2 NATIONAL TRENDS

National and state initiatives to require a greater proportion of energy consumption from clean energy sources³³ have catalyzed significant growth in the development of a wide range of alternative energy sources, especially LFG. In 1994, the US Environmental Protection Agency created the Landfill Methane Outreach Program to provide technical assistance to landfills to recover and use methane for energy generation. Currently more than a fifth of the 2,400 operating or recently closed landfills generate energy from methane. The EPA estimates another 540 of these landfills could efficiently produce electricity from methane capture.³⁴

Waste-to-energy (WTE) facilities, those which recover energy in forms of heat and electricity through a variety of processes, have become cleaner and more efficient as well. Over the past decade, WTE pollution-control technology has resulted in the near-elimination of common and dangerous toxins.³⁵ Furthermore, rather than discouraging recycling, the presence of WTE activity seems to be positively correlated with recycling activity.³⁶

³² Calculated via EPA's LFG Energy Benefits Calculator.

³³ Waste-to-energy has been recognized as renewable energy source by the US government for nearly thirty years under a variety of statutes, regulations, and policies. "The 2010 ERC Directory of Waste-to-Energy Plants," Energy Recovery Council.

³⁴ "An Overview of Landfill Gas Energy in the United States," US Environmental Protection Agency (June 2012).

³⁵ "Waste-to-Energy Technology is Cleaner and Safer than Generally Believed," MinnPost (June 6, 2013).

³⁶ "A Compatibility Study: Recycling and Waste-to-Energy Work in Concert," Governmental Advisory Associates, Inc. (September 2008).

4.3 COMMONWEALTH TRENDS

Pennsylvania has long been a leader in **landfill-to-gas (LFG) energy generation**. For example, the EPA named it State Partner of the Year for landfill energy use in 2006. The Commonwealth trails only California in the number of operational LFG projects (see Table 4.1).³⁷ Pennsylvania is also home to six waste-to-energy (WTE) facilities that handle about 10 percent of the waste stream.

Table 4.1 – Top 10 States by Operational Landfill-to-Gas Projects, as of July 2013

Rank	State	Operational Projects	Candidate Landfills ³⁸
1	California	78	32
2	Pennsylvania	43	8
3	Michigan	39	8
4	Illinois	33	25
5	Virginia	31	9
6	New York	29	3
T7	Texas	28	50
T7	Wisconsin	28	6
9	North Carolina	27	12
T10	Ohio	22	18
T10	Indiana	22	14

Source: Landfill Methane Outreach Program - U.S. Environmental Protection Agency (2013)

These successes stem from the partnership landfills in the Commonwealth have with energy companies and manufacturers to take advantage of their energy generation capabilities. For example, the Conestoga Landfill Gas Recovery Project, which provides several businesses in Lancaster and Berks counties with green energy, represents collaboration between a landfill, a waste services provider, a gas utility company, and a renewable energy company.³⁹

The waste industry in Pennsylvania utilizes some of the most powerful technologies in methane gas capture, with a high rate of Btu capture as well as combined heat and power generation

³⁷ "The Energy Report 2008," Texas Comptroller of Public Accounts (May 6, 2008).

³⁸ Defined as: "Landfill is accepting waste or has been closed 5 years or less, has at least 1 million tons of waste, and does not have an operational, under-construction, or planned project; can also be designated based on actual interest by the site."

³⁹ "Landfill Gas Piped to Businesses in Pennsylvania," Biomass Magazine (June 4, 2009).

capabilities. Three new LFG projects announced within the past year – in Franklin, Lancaster, and Lycoming counties – will provide enough power for about 15,000 houses.⁴⁰ Of the 25 landfills surveyed for this report, 19 reported energy generation representing an aggregate 24 million tons of waste processed.

4.4 NEW DEVELOPMENTS AND OPPORTUNITIES FOR THE COMMONWEALTH

Like most states, the Commonwealth has a mandate to achieve a certain percentage of its energy consumption from alternative energy sources. The Alternative Energy Portfolio requires that the Commonwealth meet 18 percent of its energy demands through the use of alternative and clean energy by 2020. The municipal waste industry is an important part of meeting that goal by simultaneously maintaining the Commonwealth's status as a leader in effective waste management and meeting the demand for alternative energy generation.

Furthermore, the industry is committed not only to alternative energy generation, via the production of LFG, but also to alternative energy consumption, via the use of liquefied natural gas (LNG). For example, Advanced Disposal Services recently commenced a 10-year disposal contract with the Centre County Solid Waste Authority to transport materials from the Centre County Transfer Station to an Advanced Disposal landfill in Kersey. The tractors performing this work will use LNG, which is a cleaner burning alternative to diesel fuel and which therefore will result in dramatically reduced carbon emissions.⁴¹

⁴⁰ "Biogas Energy Project Opens at Pa. Landfill," *Biomass Magazine* (May 3, 2013); "Dart Container Cuts Ribbon on Landfill-Gas Energy Project," *Lancaster Intelligencer Journal* (November 30, 2012); "Landfill Gas-to-Energy Project Unveiled in Pennsylvania," *Power Engineering* (October 11, 2012).

⁴¹ Advanced Disposal Services (November 2013).

5.0 INTANGIBLE BENEFITS

Within a difficult economic climate, individual members of the municipal waste industry have continued to invest, financially and relationally, in the local communities in which they have locations. A sample of local initiatives from survey respondents includes the following:

1. Since its inception in 2003, Keep Pennsylvania Beautiful has enjoyed the commitment of the municipal waste industry, and the membership and participation of individual PWIA members, in its efforts to empower Pennsylvanians to keep local communities clean and beautiful.
2. Waste Management runs the Charitable Contributions program, which provides donations to nonprofits in local communities in which it has locations, to improve the environment and to provide environmental education offerings.
3. In 2008, Advanced Disposal Services constructed a trout nursery on the site of its Greentree Landfill, which has since then raised and released thousands of trout into local streams each year.
4. The IESI Blue Ridge Landfill has made \$25,000 donations to Make-A-Wish and to its local library annually for several years. It also has a scholarship program which gives five \$2,000 awards each year to local high school seniors.
5. Philadelphia Hauling provides funds and donated services to sponsor its local Cub Scout organizations, youth baseball leagues, and local school events.
6. All members of PWIA regularly participate in municipal environmental cleaning events such as the Great American Clean Up Pennsylvania and the Ohio River Sweep, and provided safe and reliable disposal services for cleanup debris in the aftermath of the cleanup from Hurricane Sandy.

6.0 ECONOMIC AND FISCAL IMPACTS

6.1 SECTION OVERVIEW

The economic impact of the municipal waste industry in the Commonwealth is larger than its direct economic footprint, because of spillover impacts from support industries and from employee spending. The purpose of this section is to show the composition and scale of that overall economic impact, as well as of the fiscal (i.e. tax revenue) impacts that result from it.

6.2 ECONOMIC IMPACT FROM ANNUAL OPERATIONS

As noted above, the municipal waste industry in the Commonwealth represents about \$2.3 billion in annual operating expenditures and directly employs about 12,000 people. This, in turn, generates additional expenditures and supports additional employment throughout the Commonwealth. **The annual economic impact of the municipal waste industry in the Commonwealth is \$4.2 billion, supporting 26,000 jobs** and about \$1.4 billion in labor income (see Table 6.1, Table 6.2, and Figure 6.1). In other words, the municipal waste industry's annual operations create spillover impacts totaling \$2.0 billion and supporting 15,000 additional jobs and \$700 million in labor income.

Table 6.1 – Economic Impact Generated by the Municipal Waste Industry within the Commonwealth of Pennsylvania Economy

Economic Impact within the Commonwealth Economy	Expenditures	Employment	Labor Income
Direct Impacts	\$2.27 Billion	11,640 Jobs	\$680 Million
Indirect and Induced Impacts	\$1.95 Billion	14,620 Jobs	\$690 Million
Total Impacts	\$4.22 Billion	26,260 Jobs	\$1.37 Billion

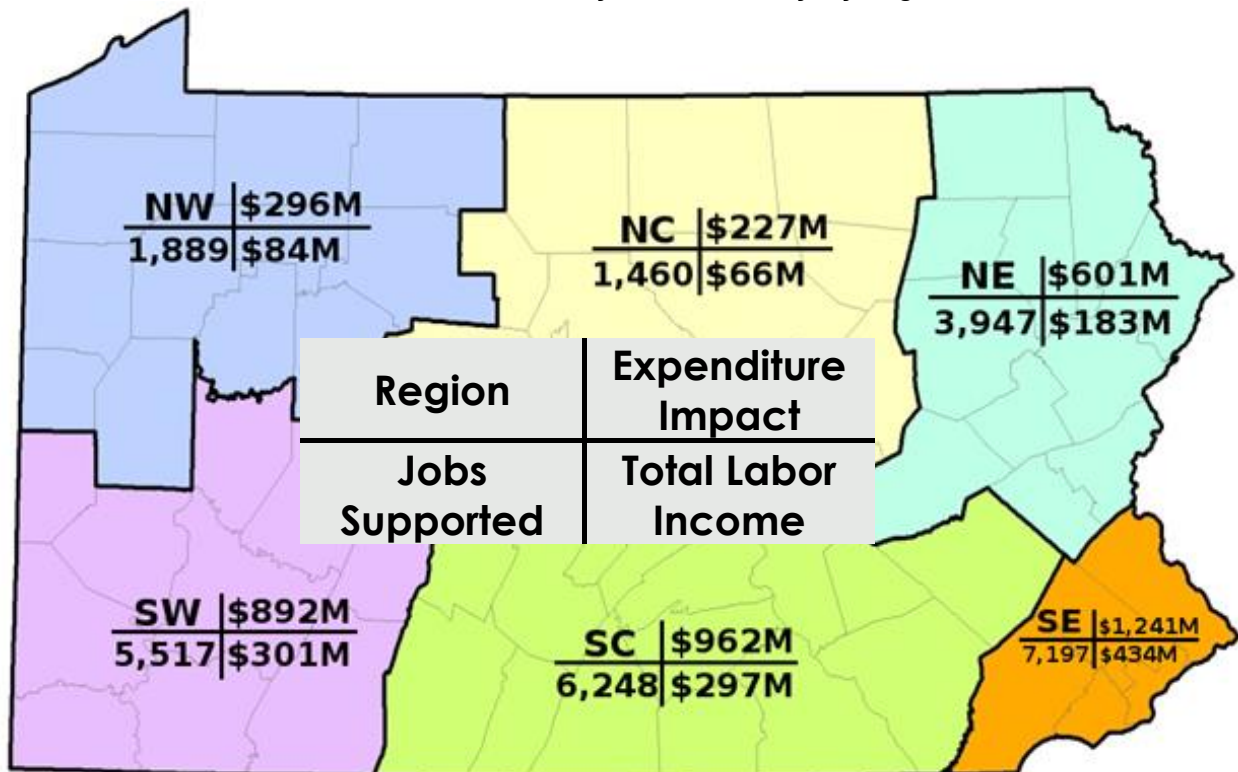
Source: IMPLAN (2012), Econsult Solutions, Inc. (2013)

Table 6.2 – Economic Impact Generated by the Municipal Waste Industry within the Commonwealth of Pennsylvania Economy, by Region

Economic Impact within the Commonwealth Economy	NC	NE	NW	SC	SE	SW	PA
Direct Expenditures (\$M)	\$141	\$331	\$177	\$533	\$634	\$456	\$2,272
Indirect and Induced Expenditures (\$M)	\$86	\$270	\$120	\$429	\$607	\$436	\$1,947
Total Expenditures (\$M)	\$227	\$601	\$296	\$962	\$1,241	\$892	\$4,219
Total Employment (Jobs)	1,460	3,950	1,890	6,250	7,200	5,520	26,260
Total Labor Income (\$M)	\$66	\$183	\$84	\$297	\$434	\$301	\$1,365

Source: IMPLAN (2012), Econsult Solutions, Inc. (2013)

Figure 6.1 – Total Economic Impact Generated by the Municipal Waste Industry within the Commonwealth of Pennsylvania Economy, by Region



Source: Pennsylvania Department of Environmental Protection (2013), Econsult Solutions (2013)

6.3 INDUSTRY DISTRIBUTION OF ECONOMIC IMPACT FROM ANNUAL OPERATIONS

A significant part of the annual statewide economic impact resulting from the municipal waste industry in the Commonwealth takes place within the municipal waste industry itself. However, much of the impact is spread across a multitude of industries, reflecting **the value of the municipal waste industry in the Commonwealth in producing economic gains for a wide range of firms and sectors** and in being a major contributor of economic activity throughout the Commonwealth. It is estimated that about 40 percent of the expenditure impact and about 51 percent of the employment impact is in industries besides “waste management and remediation services,” with the remainder impacting a wide variety of industries (see Table 6.3).

Table 6.3 – Industry Distribution of Economic Impact Generated by the Municipal Waste Industry within the Commonwealth of Pennsylvania Economy

Industry	% of Expenditure Impact within the Commonwealth	Industry	% of Employment Impact within the Commonwealth
Waste management and remediation services	59.9%	Waste management and remediation services	49.2%
Imputed rental activity for owner-occupied dwellings	2.6%	Food services and drinking places	5.2%
Monetary authorities and depository credit intermediation activities	1.9%	Employment services	3.6%
Insurance carriers	1.8%	Real estate establishments	2.0%
Food services and drinking places	1.7%	Private hospitals	1.6%
All other industries	32.1%	All other industries	38.3%

Source: IMPLAN (2012), Econsult Solutions, Inc. (2013)

6.4 FISCAL IMPACT FROM ANNUAL OPERATIONS – STATE TAXES

This composition and scale of economic impact in turn produces significant fiscal impacts for the Commonwealth. From direct tax payments and spillover effects in the Commonwealth, it is estimated that the \$4.2 billion in annual statewide economic impact produces **about \$100 million in tax revenues for the Commonwealth each year** (see Table 6.4). In other words, the overall footprint of the municipal waste industry in the Commonwealth – its own annual operations as well as spillover impacts that result from those operations – produces tax base increases that result in about \$100 million in tax revenues for the Commonwealth.

Table 6.4 – Fiscal Impact Generated by the Municipal Waste Industry to the Commonwealth of Pennsylvania Government, by Region (in \$M)

Fiscal Impact to the Commonwealth Government	NC	NE	NW	SC	SE	SW	PA
Income Tax Revenues	\$1.4	\$3.4	\$1.8	\$5.6	\$7.4	\$5.2	\$24.8
Sales Tax Revenues	\$3.4	\$9.3	\$4.4	\$14.9	\$20.3	\$14.4	\$66.6
Business Tax Revenues	\$0.4	\$1.1	\$0.5	\$1.8	\$2.4	\$1.7	\$7.9
Total Tax Revenues	\$5.2	\$13.8	\$6.7	\$22.2	\$30.0	\$21.3	\$99.3

Source: IMPLAN (2012), Econsult Solutions, Inc. (2013)

6.5 FISCAL IMPACT FROM ANNUAL OPERATIONS – LOCAL TAXES

These amounts represent taxes paid to the Commonwealth by the municipal waste industry as well as state tax revenues generated from the spillover impacts produced by the municipal waste industry. In addition, there are local tax revenue impacts. For example, establishments within the municipal waste industry pay property taxes to localities. Those survey respondents which reported property tax paid amounts represented about **\$6.5 million in direct property taxes to local and county governments and to school districts** (see Table 6.5).⁴²

⁴² Some of these establishments are also required to pay other local taxes, such as on personal income or business income. These represent additional revenues for localities. Insufficient survey response on local taxes paid precludes an accounting of those amounts in this report. Since it is certain that the municipal waste industry represented some direct payments of local income taxes, not assigning a number to this amount (i.e. assuming that the municipal waste industry generated no local income taxes within the Commonwealth) yields aggregate estimates that are conservatively low.

Table 6.5 – Aggregate Amount of Property Taxes Paid as Reported by Survey Respondents Representing Individual Members of the Municipal Waste Industry within the Commonwealth of Pennsylvania in 2012

Survey Respondent Type	# Respondents Who Reported Property Taxes Paid ⁴³	2012 Amount
Landfills	24	\$5.1 Million
Haulers	17	\$1.0 Million
Recyclers	5	\$0.4 Million
Total for all Survey Respondents	45	\$6.5 Million

Source: Econsult Solutions, Inc. (2013)

6.6 FISCAL IMPACT FROM ANNUAL OPERATIONS – STATE AND LOCAL FEES

The waste industry is also subject to a number of fees imposed at the state, county, and municipal levels. Disposal, recycling, environmental stewardship fees are paid to the Commonwealth and are the same for all establishments within the municipal waste industry, at a total of \$6.25 per ton; these total over \$80 million per year (see Table 6.6). Host municipality fees vary greatly, averaging \$3.53 per ton; these total about \$60 million per year (see Table 6.7).⁴⁴

This means that **the average fee paid to state and local governments by the municipal waste industry is about \$10 per ton, representing about \$140 million per year in state and local fees paid** (see Table 6.8).

⁴³ Because property taxes paid are not necessarily uniform across establishments, these figures were not extrapolated upwards to account for non-respondents. Since it is certain that non-respondents did in fact paid property taxes, not extrapolating (i.e. assuming that non-respondents paid no property taxes) yields aggregate estimates that are conservatively low.

⁴⁴ A weighted average host municipality fee amount per ton was calculated from information provided by survey respondents. In some cases, survey respondents paid host fees to multiple localities. This average fee amount per ton was multiplied by statewide tonnage to arrive at an aggregate fee amount paid to localities.

Table 6.6 – Aggregate Amount of Additional Fees Paid to the Commonwealth of Pennsylvania by the Municipal Waste Industry in 2012 (in \$M)

Fee Type	Rate per Ton	Amount
Growing Greener Fee ⁴⁵	\$4.00	\$48.9 Million
Recycling Fee	\$2.00	\$29.7 Million
Environmental Stewardship Fee	\$0.25	\$3.5 Million
Total Fees Paid	\$6.25	\$82.2 Million

Source: Pennsylvania Department of Environmental Protection (2012), Pennsylvania Department of Revenue (2013), Econsult Solutions (2013)

Table 6.7 – Host Municipality Fees Paid to Local Governments within the Commonwealth of Pennsylvania by the Municipal Waste Industry in 2012

Fee Type	Average Local Rate per Ton	State-Wide Estimate
Host Fees to Local Municipalities	\$3.53	\$59.9 Million

Source: Econsult Solutions (2013)

Table 6.8 – State and Local Fees Paid to the Commonwealth of Pennsylvania by the Municipal Waste Industry in 2012

	State	Local	State + Local
Fee per Ton	\$6.25	\$3.53	\$9.78
Total Fees Paid	\$82.2 Million	\$59.9 Million	\$142.1 Million

Source: Econsult Solutions (2013)

6.7 FISCAL IMPACT FROM ANNUAL OPERATIONS – TOTAL

All told, then, **the operating activities of the municipal waste industry within the Commonwealth generate about \$250 million each year in various state and local taxes and fees** (see Table 6.9). These revenues come in the form of host fees paid to state and local government, property taxes paid by industry members to local governments, and state taxes generated by industry activity and by the spillover effects of that activity. This makes the

⁴⁵ A municipal disposal fee created to generate dedicated funds for environmental protection. First established in 1999 as a result of the Growing Greener: Environmental Stewardship and Watershed Protection Act.

municipal waste industry a major contributor of revenues to the Commonwealth and to the local governments where industry members are located.

Table 6.9 – Aggregate State and Local Fiscal Impact from the Operating Activities of the Municipal Waste Industry within the Commonwealth of Pennsylvania in 2012

Fiscal Impact Category	2012 Amount
Statewide Economic Impact from Municipal Waste Industry and Its Spillover Effects	\$99.3 Million
Property Taxes Paid to Localities by Establishments within the Municipal Waste Industry	\$6.5 Million
Fees Paid to the Commonwealth by the Municipal Waste Industry	\$82.2 Million
Fees Paid to Localities by the Municipal Waste Industry	\$59.9 Million
Aggregate State and Local Fiscal Impact Each Year	\$247.9 Million

Source: Econsult Solutions, Inc. (2013)

6.8 ECONOMIC AND FISCAL IMPACT FROM CAPITAL EXPENDITURES

Additionally, the capital improvements of \$400 million invested by the survey respondents between 2010 and 2012 created significant one-time economic impacts within the Commonwealth economy and a significant fiscal impact to the Commonwealth government. It is estimated that **the economic impact of these capital expenditures was about \$800 million, supporting about 6,000 jobs within the Commonwealth economy and generating about \$20 million in tax revenues for the Commonwealth government** (see Table 6.10 and Table 6.11). These impacts from capital investments were over and above that generated by operating expenditures.

Table 6.10 – Economic Impact Generated by Capital Expenditures Made by Survey Respondents Representing Individual Members of the Municipal Waste Industry within the Commonwealth of Pennsylvania between 2010 and 2012

Economic Impact within the Commonwealth Economy	PA
Direct Expenditures	\$410 Million
Indirect and Induced Expenditures	\$380 Million
Total Expenditures	\$790 Million
Total Employment	6,100 Jobs
Total Earnings	\$340 Million

Source: US Department of Commerce (2011), EMSI (2013), Econsult Solutions, Inc. (2013)

Table 6.11 – Fiscal Impact Generated by Capital Expenditures Made by Survey Respondents Representing Individual Members of the Municipal Waste Industry within the Commonwealth of Pennsylvania between 2010 and 2012

Fiscal Impact to the Commonwealth Government	PA
Income Tax Revenues	\$6.2 Million
Sales Tax Revenues	\$12.9 Million
Business Tax Revenues	\$1.5 Million
Total Tax Revenues	\$20.6 Million

Source: US Department of Commerce (2011), EMSI (2013), Econsult Solutions, Inc. (2013)

6.9 CONCLUSION

Through waste collection, recycling, and disposal, the municipal waste industry is a positive contributor to the Commonwealth of Pennsylvania and to local communities. It represents a considerable bloc of job opportunities for local residents and contract opportunities for local vendors and is also a major payer of taxes and fees to the Commonwealth and to various local governments (see Table 6.12). And its technological innovations establish Pennsylvania as a national leader in recycling and energy generation and produce positive environmental outcomes.

Table 6.12 – Aggregate Impact from the Operating Activities of the Municipal Waste Industry within the Commonwealth of Pennsylvania in 2012

Economic Impacts	Fiscal Impacts
Statewide Expenditure Impact of \$4.219 Billion	\$99.3 Million in State Tax Revenues Generated
Statewide Employment Impact of 26,260 Jobs	\$6.5 Million in Local Property Taxes Paid
Statewide Labor Income Impact of \$1.365 Billion	\$142.1 Million in State and Local Fees Paid

Source: US Department of Commerce (2011), EMSI (2013), Econsult Solutions, Inc. (2013)

APPENDIX A – ECONOMIC AND FISCAL IMPACT MODEL THEORY

A.1 HISTORY

The theory behind input-output modeling stretches as far back as the mid 17th century, when Sir William Petty described the interconnectedness of “production, distribution, and wealth disposal.” While Perry can be credited with noticing links between economies, input-output modeling did not begin to take true form until the mid 18th century, when French physician François Quesnay created the *Tableau Économique*. His work detailed how a landowner spends his earnings on goods from farms and merchants, who in turn spend their money on a host of goods and services. Over the course of the century, an algebraic framework was added by Achille-Nicholas Isnard. Robert Torrens and Léon Walras refined the model by establishing the connections between profits and production.

The modern input-output system can be attributed to Wassily Leontief. In his thesis, “The Economy as a Circular Flow” (1928), he outlined the economy as an integrated system of linear equations relating inputs and outputs. This framework soon gained popularity, and became a widely accepted analytical tool. In 1936, Leontief produced the first input-output analysis of the US. Leontief’s work became the US Department of Commerce’s Bureau of Economic Analysis’s (BEA) standard benchmark for US production in the 1950’s. Leontief received a Nobel Prize for his work in 1973.

In 1976 the USDA Forest Service became required to submit five year management plans to the federal government concerning the socio-economic effects of resource use. Through extensive surveying, the impacts of each industry could be determined at local levels. This directly resulted in the creation of IMPLAN software for measuring economic impacts. By the late 1980’s the University of Minnesota began to offer the software to a wider audience. Seeing the need to update economic databases and improve the existing software, the Minnesota IMPLAN Group (MIG) was formed in 1993. Using a similar methodology to the USDA Forest Service, MIG was able to provide a quality input-output modeling software to a wider range of users with frequent database updates.

A.2 APPLICATION

The use and application of multipliers are fairly basic and intuitive. Multipliers, in their most basic form, are the result of an algebraic analysis expressing how two inputs are interconnected in the production of an output. The result of the equation generates a multiplier that is broken down into direct, indirect, and induced effects. In a generalized example: if the multiplier for good “X” to good “Y” is 3, then the direct of good “X” on “Y” is 1, with indirect and induced effects of 2. Essentially, every unit of good “X” supports 2 units of good “Y”.

When implemented on a large complex scale, such as that of the US economy or any subsection of it, multiplier effects across industries can be complicated. However, the same general concept

comes into play. Each industry has largely different and varied inputs into other industries. The quantity of the output is largely decided by the scale and efficiency of the industries involved. As a result, the sum of those inputs equates to an output product plus a value added/component. By arranging these inputs and outputs by industry in a matrix, and performing some algebra to find the Leontief inverse matrix, each industry's effect on final demand can be estimated. Additionally, the direct, indirect, and induced effects can also be determined. Direct effects include direct purchases for production, indirect effects include expenses during production, and induced effects concern the expenditures of employees directly involved with production. Using building construction as an example, the direct effects would include materials, brick, steel, and mortar, the indirect effects would involve the steel fabrication, concrete mixing, and the induced effects would consider the construction workers purchases from their wages. While impacts vary in size, each industry has rippling effects throughout the economy. By using an input-output model, these effects can be more accurately quantified and explained.

IMPLAN is one of several popular choices for regional input-output modeling. Each system has its own nuances in establishing proper location coefficients. IMPLAN uses a location quotient to determine its regional purchase coefficient (RPC). This represents the proportion of demand for a good that is filled locally; this assessment helps determine the multiplier for the localized region. Additionally, IMPLAN also accounts for inter-institutional transfers (e.g. firms to households, households to the government, etc...) through its social account matrix (SAM) multipliers. IMPLAN takes the multipliers and divides them into 440 industry categories in accordance to the North American Industrial Classification System (NAICS) codes. A comprehensive breakdown of a region's multipliers by industry can be shown.

Despite the usefulness of input-output modeling, there are some shortcomings to the system. Notably, input-output models ignore economies of scale. Input-output models assume that costs and inputs remain proportionate through different levels of production. Further, multipliers are not generally updated on a timely basis; most multipliers are prone to be outdated with the current economy. If the multipliers are sourced from a year of a recession economy, the multipliers may not accurately represent the flows from an economic boom period. Additionally, the multipliers may not capture sudden legal or technological changes which may improve or decrease efficiency in the production process. Regardless, I-O models still serve as the standard in the estimation of local and regional impacts.

A.3 ECONOMIC IMPACT MODEL METHODOLOGY

The methodology and input-output model used in this economic impact analysis are considered standard for estimating such expenditure impacts, and the results are typically recognized as reasonable and plausible effects, based on the assumptions (including data) used to generate the impacts. In general, one can say that any economic activity can be described in terms of the total output generated from every dollar of direct output. If an industry in a given region sells \$1 million of its goods, there is a direct infusion of \$1 million into the region. These are referred to as direct output.

However, the economic impact on the region does not stop with that initial direct expenditure. Regional suppliers to that industry have also been called upon to increase their production to

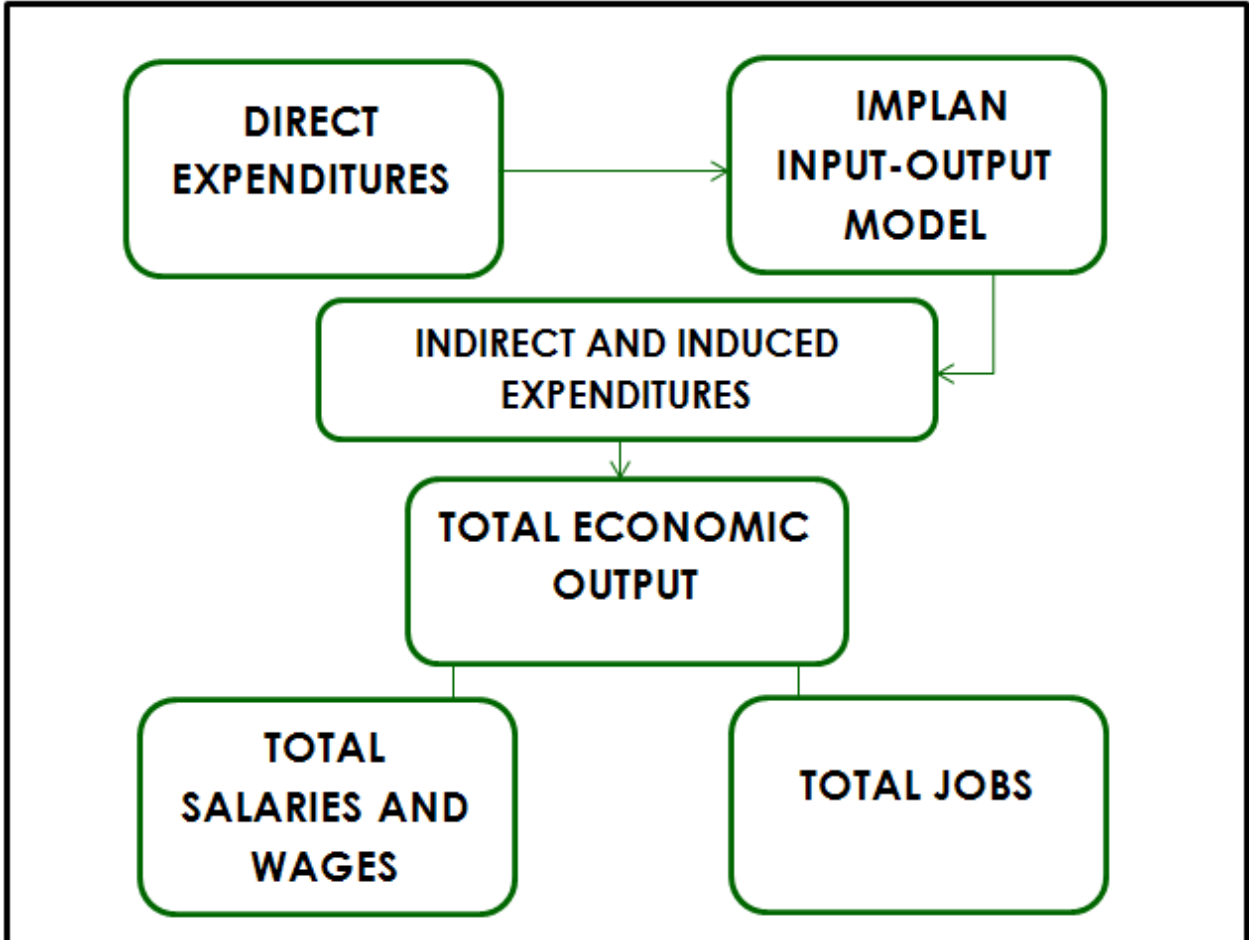
meet the needs of the industry to produce the \$1 million in goods sold. Further, suppliers of these same suppliers must also increase production to meet their increased needs as well. These are referred to as indirect output. In addition, these direct and indirect output require workers, and these workers must be paid for their labor. These wages and salaries will, in turn, be spent in part on goods and services produced locally, engendering another round of impacts. These are referred to as induced expenditures.

Direct output is fed into a model constructed by Econsult Solutions and based on IMPLAN data. The model then produces a calculation of the total expenditure effect on the regional economy. This total effect includes the initial direct expenditure effect, as well as the ripple effects described, the indirect and induced expenditure effects.

Part of the total expenditure effect is actually the increase in total wages and salaries (usually referred to as labor income), which the model can separate from the expenditure estimates. Direct payroll estimates are fed into the “household” industry of the input-output model. Impacts of this industry are estimated using the personal consumption expenditure breakdown of the national input-output table and are adjusted to account for regional consumption spending and leakages from personal taxes and savings. The direct, indirect, and induced labor income represent a component of the total economic impact attributable to wages and salaries. Finally, the model calculates the total expenditures affecting the various industries and translates this estimate into an estimate of the total labor (or jobs) required to produce this output.

In short, the input-output model estimates the total economic activity in a region that can be attributed to the direct demand for the goods or services of various industries. This type of approach is used to estimate the total economic activity attributable to the expenditures associated with various types of spending in the region (see Figure A.1 and Table A.1).

Figure A.1 – Flowchart of Input-Output Methodology for Estimating Economic Impact



Source: Econsult Solutions, Inc. (2013)

Table A.1 – Glossary of Terms for Input-Output Models

Multiplier Effect – the notion that initial outlays have a ripple effect on a local economy, to the extent that direct output lead to indirect and induced output.

Economic Impacts – total expenditures, employment, and labor income generated.

Fiscal Impacts – local and/or state tax revenues generated.

Direct Output – initial outlays usually associated with the project or activity being modeled; examples: one-time upfront construction and related expenditures associated with a new or renovated facility, annual expenditures associated with ongoing facility maintenance and/or operating activity.

Direct Employment – the full time equivalent jobs associated with the direct output.

Direct Labor income – the salaries and wages earned by employees, contractors, and proprietors as part of the direct output.

Indirect Output – indirect and induced outlays resulting from the direct output; examples: vendors increasing production to meet new demand associated with the direct output, workers spending direct labor income on various purchases within the local economy.

Indirect Employment – the full time equivalent jobs associated with the indirect output.

Indirect Labor income – the salaries and wages earned by employees, contractors, and proprietors as part of the indirect output.

Total Output – the sum total of direct output and indirect output.

Total Employment – the sum total of direct employment and indirect employment.

Total Labor income – the sum total of direct labor income and indirect labor income.

Source: Econsult Solutions (2013)

A.4 FISCAL IMPACT MODEL METHODOLOGY

The IMPLAN model provides estimates of the economic impact of a new project or program on the regional economy. It does provide only a rough estimate of the combined fiscal impact of the increased economic activity on state and local governments. Consequently, Econsult has constructed a model that takes the output from the IMPLAN model and generates detailed estimates of the increases in state and local tax collections that arise from the new project. Those revenues are in fact a part of the total economic impact of a new project that is often ignored in conventional economic impact analyses.

The IMPLAN model provides estimates of direct, indirect, and induced expenditures, labor income, and employment within the defined region. The Econsult fiscal impact model combines the IMPLAN output with the relevant tax types and tax bases associated with the jurisdiction or jurisdictions for which fiscal impact is being modeled. Specifically, the estimated labor income supported by the direct, indirect, and induced expenditures generated by the model are used to

apportion the net increase in the relevant tax bases and therefore in those tax revenue categories. The resulting estimates represent the projected tax revenue gains to the jurisdiction or jurisdictions as a result of the increased business activity and its attendant indirect and induced effects.

A.5 SOURCES

Miller, Ronald E., and Peter D. Blair. *Input-output Analysis Foundations and Extensions*. Cambridge, UK: Cambridge UP, 2009. Print.

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"Researching IMPLAN Data." Minnesota IMPLAN Group LLC, 2012.



APPENDIX B – COUNTY COMPOSITION OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION REGIONS

Table B.1 – Member Counties of DEP Regions

DEP Region	Counties
Northcentral (NC)	Bradford, Cameron, Centre, Clearfield, Clinton, Columbia, Lycoming, Montour, Northumberland, Potter, Snyder, Sullivan, Tioga, Union
Northeast (NE)	Carbon, Lackawanna, Lehigh, Luzerne, Monroe, Northampton, Pike, Schuylkill, Susquehanna, Wayne, Wyoming
Northwest (NW)	Butler, Clarion, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Venango, Warren
Southcentral (SC)	Adams, Bedford, Berks, Blair, Cumberland, Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lancaster, Lebanon, Mifflin, Perry, York
Southeast (SE)	Bucks, Chester, Delaware, Montgomery, Philadelphia
Southwest (SW)	Allegheny, Armstrong, Beaver, Cambria, Fayette, Greene, Indiana, Somerset, Washington, Westmoreland

Source: Pennsylvania Department of Environmental Protection (2013)

APPENDIX C – DEFINITION OF NAICS CODES CONSIDERED TO BE INCLUDED IN THE MUNICIPAL WASTE INDUSTRY

Table C.1 – NAICS Codes Considered to be Included in the Municipal Waste Industry (Bold, Underlined, and Highlighted)

NAICS	NAICS Name
423930	Recyclable Material Merchant Wholesalers
56	Administrative and Support and Waste Management and Remediation Services
561	Administrative and Support Services
562	Waste Management and Remediation Services
<u>5621</u>	<u>Waste Collection</u>
<u>56211</u>	<u>Waste Collection</u>
<u>562111</u>	<u>Solid Waste Collection</u>
562112	Hazardous Waste Collection
<u>562119</u>	<u>Other Waste Collection</u>
<u>5622</u>	<u>Waste Treatment and Disposal</u>
<u>56221</u>	<u>Waste Treatment and Disposal</u>
562211	Hazardous Waste Treatment and Disposal
<u>562212</u>	<u>Solid Waste Landfill</u>
562213	Solid Waste Combustors and Incinerators
<u>562219</u>	<u>Other Nonhazardous Waste Treatment and Disposal</u>
5629	Remediation and Other Waste Management Services
56291	Remediation Services
562910	Remediation Services
<u>56292</u>	<u>Materials Recovery Facilities</u>
<u>562920</u>	<u>Materials Recovery Facilities</u>
56299	All Other Waste Management Services
562991	Septic Tank and Related Services
562998	All Other Miscellaneous Waste Management Services

Source: US Office of Management and Budget (2013), Econsult Solutions, Inc. (2013)

All definitions below are available on the US Census Bureau website.

562111 Solid Waste Collection

This U.S. industry comprises establishments primarily engaged in one or more of the following: (1) collecting and/or hauling nonhazardous solid waste (i.e., garbage) within a local area; (2) operating nonhazardous solid waste transfer stations; and (3) collecting and/or hauling mixed recyclable materials within a local area.

Cross-References. Establishments primarily engaged in:

- Long-distance trucking of waste--are classified in Industry [484230](#), Specialized Freight (except Used Goods) Trucking, Long-Distance;
- Collecting and/or hauling in combination with disposal of nonhazardous waste materials--are classified in Industry [56221](#), Waste Treatment and Disposal;
- Collecting and/or hauling hazardous waste within a local area and/or operating hazardous waste transfer stations--are classified in U.S. Industry [562112](#), Hazardous Waste Collection;
- Collecting and removing debris, such as brush or rubble, within a local area--are classified in U.S. Industry [562119](#), Other Waste Collection; and
- Operating facilities for separating and sorting recyclable materials from nonhazardous waste streams (i.e., garbage) and/or for sorting commingled recyclable materials, such as paper, plastics, and metal cans, into distinct categories--are classified in Industry [562920](#), Materials Recovery Facilities.

562119 Other Waste Collection

This U.S. industry comprises establishments primarily engaged in collecting and/or hauling waste (except nonhazardous solid waste and hazardous waste) within a local area. Establishments engaged in brush or rubble removal services are included in this industry.

Cross-References. Establishments primarily engaged in:

- Long-distance trucking of waste--are classified in Industry [484230](#), Specialized Freight (except Used Goods) Trucking, Long-Distance;
- Collecting and/or hauling in combination with disposal of waste materials--are classified in Industry Group [5622](#), Waste Treatment and Disposal;
- Collecting and/or hauling nonhazardous solid waste (i.e., garbage) or mixed recyclable materials within a local area or operating nonhazardous solid waste transfer stations--are classified in U.S. Industry [562111](#), Solid Waste Collection;

- Collecting and/or hauling hazardous waste within a local area or operating hazardous waste transfer stations--are classified in U.S. Industry [562112](#), Hazardous Waste Collection; and
- Operating facilities for separating and sorting recyclable materials from nonhazardous waste streams (i.e., garbage) and/or for sorting commingled recyclable materials, such as paper, plastics, and metal cans, into distinct categories--are classified in Industry [562920](#), Materials Recovery Facilities.

562212 Solid Waste Landfill

This U.S. industry comprises establishments primarily engaged in (1) operating landfills for the disposal of nonhazardous solid waste or (2) the combined activity of collecting and/or hauling nonhazardous waste materials within a local area and operating landfills for the disposal of nonhazardous solid waste. These establishments may produce byproducts, such as methane.

Cross-References. Establishments primarily engaged in:

- Operating treatment and/or disposal facilities for hazardous waste--are classified in U.S. Industry [562211](#), Hazardous Waste Treatment and Disposal;
- Operating combustors and incinerators for the disposal of nonhazardous solid waste--are classified in U.S. Industry [562213](#), Solid Waste Combustors and Incinerators;
- Collecting, treating, and disposing waste through sewer systems or sewage treatment facilities--are classified in Industry [221320](#), Sewage Treatment Facilities;
- Operating nonhazardous waste treatment and disposal facilities (except landfills, combustors, incinerators, and sewer systems or sewage treatment facilities)--are classified in U.S. Industry [562219](#), Other Nonhazardous Waste Treatment and Disposal; and
- Manufacturing compost--are classified in U.S. Industry [325314](#), Fertilizer (Mixing Only) Manufacturing.

562219 Other Nonhazardous Waste Treatment and Disposal

This U.S. industry comprises establishments primarily engaged in (1) operating nonhazardous waste treatment and disposal facilities (except landfills, combustors, incinerators and sewer systems or sewage treatment facilities) or (2) the combined activity of collecting and/or hauling of nonhazardous waste materials within a local area and operating waste treatment or disposal facilities (except landfills, combustors, incinerators and sewer systems, or sewage treatment facilities). Compost dumps are included in this industry.

Cross-References. Establishments primarily engaged in:



- Operating landfills for the disposal of nonhazardous solid waste--are classified in U.S. Industry 562212, Solid Waste Landfill;
- Operating combustors and incinerators for the disposal of nonhazardous solid waste--are classified in U.S. Industry 562213, Solid Waste Combustors and Incinerators;
- Collecting, treating, and disposing waste through sewer systems or sewage treatment facilities--are classified in Industry 221320, Sewage Treatment Facilities; and
- Manufacturing compost--are classified in U.S. Industry 325314, Fertilizer (Mixing Only) Manufacturing.

562920 Materials Recovery Facilities

This industry comprises establishments primarily engaged in (1) operating facilities for separating and sorting recyclable materials from nonhazardous waste streams (i.e., garbage) and/or (2) operating facilities where commingled recyclable materials, such as paper, plastics, used beverage cans, and metals, are sorted into distinct categories.

Cross-References. Establishments primarily engaged in:

- Merchant wholesaling automotive, industrial, and other recyclable materials are classified in Industry 423930, Recyclable Material Merchant Wholesalers.

APPENDIX D – MUNICIPAL WASTE GENERATED FROM AND COLLECTED IN THE COMMONWEALTH OF PENNSYLVANIA BY REGION

Table D.1 – Municipal Waste Generated from and Collected in the Commonwealth of Pennsylvania, by Region

Region	Municipal Waste Collection in 2006 (M tons)	% of PA Municipal Waste Collection in 2006	Municipal Waste Collection in 2012 (M tons)	% of PA Municipal Waste Collection in 2012	2006-2012 % Change
NC	0.5	5%	0.5	5%	-5%
NE	1.5	15%	1.3	15%	-16%
NW	0.6	6%	0.6	7%	-3%
SC	1.9	18%	1.7	20%	-9%
SE	3.9	38%	2.9	34%	-26%
SW	1.9	18%	1.7	20%	-10%
PA	10.3	100%	8.6	100%	-16%

Source: Pennsylvania Department of Environmental Protection (2013), Econsult Solutions, Inc. (2013)

Table D.2 – Total Waste Generated from and Collected in the Commonwealth of Pennsylvania, by Region

Region	Total Waste Collection in 2006 (M tons)	% of PA Total Waste Collection in 2006	Total Waste Collection in 2012 (M tons)	% of PA Total Waste Collection in 2012	2006-2012 % Change
NC	0.8	5%	1.0	7%	24%
NE	1.9	13%	1.7	12%	-10%
NW	0.9	6%	1.0	7%	4%
SC	3.1	21%	3.1	21%	0%
SE	5.4	36%	4.2	29%	-22%
SW	2.9	19%	3.5	24%	21%
PA	15.0	100%	14.5	100%	-3%

Source: Pennsylvania Department of Environmental Protection (2013), Econsult Solutions, Inc. (2013)

Table D.3 – Types of Waste Generated from and Collected in the Commonwealth of Pennsylvania in 2012, by Region, by Millions of Tons

Region	Residual	Sewage	Disinf Med	C&D	Ash	Asbestos	All Muni
NC	0.382	0.049	0.001	0.071	0.004	0.002	0.473
NE	0.239	0.071	0.009	0.122	0	0.001	1.265
NW	0.269	0.045	0	0.071	0.011	0.002	0.575
SC	0.774	0.059	0.022	0.260	0.250	0.010	1.710
SE	0.339	0.066	0.016	0.219	0.667	0.003	2.898
SW	1.277	0.123	0.011	0.351	0.044	0.009	1.702
PA	3.280	0.414	0.059	1.096	0.975	0.028	8.623
%	22.7%	2.9%	0.4%	7.6%	6.7%	0.2%	59.6%

Source: Pennsylvania Department of Environmental Protection (2013), Econsult Solutions, Inc. (2013)

APPENDIX E – DIRECT EXPENDITURES, EMPLOYMENT, AND EARNINGS REPRESENTED BY THE MUNICIPAL WASTE INDUSTRY IN THE COMMONWEALTH OF PENNSYLVANIA, BY REGION

Table E.1 – Direct Expenditures, Employment, and Earnings Represented by the Municipal Waste Industry in the Commonwealth of Pennsylvania in 2012, by Region⁴⁶

Region	Expenditures (\$M)	Employment (Jobs)	Labor Income (\$M)	Average Annual Salary (\$000)
NC	\$141	750	\$39.3	\$35.6
NE	\$331	1,730	\$94.1	\$44.4
NW	\$177	940	\$48.7	\$44.3
SC	\$533	2,790	\$152.8	\$50.7
SE	\$634	3,160	\$201.9	\$65.9
SW	\$456	2,290	\$143.0	\$62.3
PA	\$2,272	11,640	\$679.7	\$54.7

Source: IMPLAN (2012), Econsult Solutions, Inc. (2013)

⁴⁶ Revenue, employment and earnings figures were obtained for selected industries and sub-industries from business data provided by IMPLAN. Expenditure estimates were derived from revenue figures based on industry-wide profit margin figures.