Increased Recycling Initiative

Summary:
Support the increased recycling of municipal solid waste (MSW) sufficient to achieve an overall reduction in greenhouse gas (GHG) emissions of 5.0 million metric tons of carbon dioxide equivalent ($MMtCO_2e$) by improving the efficiency of existing programs and maximizing collections within mandated communities, first, followed by consideration of expanding requirements to other non-mandated communities.

Goal:
Increase recycling in Pennsylvania to achieve a 5.0 $MMtCO_2e$ reduction, as compared to Year 2000, which equates to increased tonnage recycled of about approximately 2.1 million tons.

Background Discussion:
Act 101, the Municipal Waste, Planning Recycling and Waste Act Reduction of 1988, provides the foundation for recycling that has resulted in comprehensive environmental and economic benefits for Pennsylvania. The Act provides for a $2/ton recycling fee on waste disposed of or processed at municipal waste landfills and resource recovery facilities in the commonwealth. In 2007, the recycling fee generated approximately $47 million annually to a Recycling Fund administered by PA DEP. However, since adoption of the $4/ton Growing Greening Fee established by Act 90 of 2002, the amount of out-of-state waste disposed of or processed in Pennsylvania has declined, such that in 2011, the recycling fee generated only approximately $37.7 million to the Recycling Fund, though this trend may be reversing.

The Recycling Fund provides support to local governments for implementation of recycling programs. The recycling fee also supports the stimulation of markets for recyclable materials. DEP is focusing Act 101 funds on programs geared toward financial sustainability, including those that are targeting new materials that were previously disposed of. Increasing the amount of materials recycled will provide direct reductions in GHG emissions.

In 2000, 2005 and 2010, Pennsylvania's recycling efforts provided GHG reductions equal to about 9.2, 9.7 and 10.8 $MMtCO_2e$, respectively. During these years the approximate tonnage of MSW recycled was 3.4, 3.6 and 4.3 million tons. According to EPA the energy conserved from manufacturing products from the 4.3 million tons of recycled feedstock, rather than using virgin raw materials or non-renewable resources, is equivalent to 1.2 billion gallons of gasoline or enough electricity to power 1.6 million homes.

When considering the impact of population growth the rate of recycling has been 27.6 percent, 28.8 percent, and 33.6 percent per capita. While there has been an annual rate of increase in recycling it is not valid to assume that this can or will remain the case for several reasons. Recycling may plateau if other policies and/or regulations or incentives are not considered. Even if a business-as-usual rate of increase continues the goal of 14.2 MMtCO2e reductions in 2020 will be still be higher than the BAU scenario that could provide GHG reductions of approximately 12.4 MMtCO2e.

As referenced above, several factors will impact future recycling rates and tonnages of MSW materials recycled. These include the following:

- The ability of municipalities to offer single-stream recycling
- The fiscal ability of municipalities currently offering recycling services that are not currently required to do so

- Reduced product and packaging weights (light-weighting) will decrease gross tonnages of materials recycled but will result in reduced GHG emissions upstream for the packaging and transport of these products.
- Greater use of e-commerce and electronic media is hastening the replacement/elimination of printed media including, newspapers, magazines and phone books.

Calculations and Methodology:

The U.S. Environmental Protection Agency's (EPA) Waste Reduction Model (WARM) was used to calculate the estimated reductions in GHG emissions. WARM provides lifecycle-based emission reductions for each of numerous types of materials being recycled or composted. Table 1 provides the WARM values with tonnage of materials recycled in PA in 2000, 2005 and 2010 and the associated GHG emissions reduced, expressed in metric tons of carbon dioxide equivalent ($MTCO_2e$).

Table 1. WARM GHG Values and PA Recycling Tonnages

Material	GHG Emissions per Ton of Material Recycled ($MTCO_2E$)	GHG Emissions per Ton of Material Composted ($MTCO_2E$)	2000 Recycled (Tons)	2000 GHG Reduced (MTCO2e)	2005 Recycled (Tons)	2005 GHG Reduced (MTCO2e)	2010 Recycled (Tons)	2010 GHG Reduced (MTCO2e)
Aluminum Cans	(8.89)	NA	17,590	156,384	47,603	423,218	39,037	347,058
Aluminum Ingot	(6.97)	NA		0				
Steel Cans	(1.80)	NA	13,936	25,114	19,074	34,373	912,956	1,645,269
Copper Wire	(4.89)	NA		0			10,658	52,136
Glass	(0.28)	NA	28,571	7,947	57,447	15,978	58,888	16,379
HDPE	(0.86)	NA	12,341	10,578	6,629	5,682	4,901	4,201
LDPE	NA	NA	37,267	0			4,894	0
PET	(1.11)	NA	6,755	7,487	6,644	7,364	5,446	6,036
LLDPE	NA	NA						
PP	NA	NA					1,542	0
PS	NA	NA	1,850	0			327	0
PVC	NA	NA					578	0
PLA	NA	(0.20)					5,789	0
Corrugated Containers	(3.11)	NA	713,552	2,219,177	660,244	2,053,386	751,248	2,336,412
Magazines/third-class mail	(3.07)	NA	24,683	75,784			30,182	92,668
Newspaper	(2.78)	NA	244,252	679,393	234,406	652,006	96,353	268,007
Office Paper	(2.85)	NA	76,304	217,815	73,939	211,063	110,572	315,636
Phonebooks	(2.65)	NA					784	2,078
Textbooks	(3.11)	NA						
Dimensional Lumber	(2.46)	NA	213,285	524,070	191,032	469,392	220,224	541,119
Medium-density Fiberboard	(2.47)	NA						
Food Scraps	NA	(0.20)	66,482	13,141	63,573	12,566	73,603	14,549
Leaves/Grass/Yard Trimmings	NA	(0.20)	585,682	115,769	557,691	110,236	484,920	95,852
Branches	NA	(0.20)						

Mixed Paper (general)	(3.52)	NA	239,283	841,762	249,233	876,762	192,736	678,017
Mixed Paper (primarily residential)	(3.52)	NA						
Mixed Paper (primarily from offices)	(3.59)	NA						
Mixed Metals	(3.97)	NA	1,074,263	4,268,428	1,084,607	4,309,527	963,236	3,827,276
Mixed Plastics	(0.98)	NA			43,352	42,556	24,290	23,844
Mixed Recyclables	(2.80)	NA			178,576	499,724	172,558	482,884
Mixed Organics	NA	(0.20)	25,183	0	24,029		15,355	0
Mixed MSW	NA	NA					18,606	0
Carpet	(2.37)	NA						
Personal Computers	(2.35)	NA	2,962	6,950	2,835	6,652	7,717	18,110
Tires	(0.39)	NA			49,730	19,430	63,975	24,996

This work plan establishes a goal equal to an increase of 5.4 million metric tons of carbon dioxide equivalent (MMTCO_2e) above the GHG reduction level of 9.2 MMTCO2e from Year 2000. This is consistent with the outcome from the original work plan from the 2009 Pennsylvania Climate Change Action Plan. The total GHG reductions therefore, would be 14.6 MMTCO2e in 2020 corresponding to approximately 5.5 million tons of recycled materials but because GHG reductions per ton of recycled materials varies, so too will the final gross tonnage recycled. Average annual rates of GHG reduction per ton of gross recycled material were used in helping to project future recycled tonnages to meet the goal.

In performing the analysis three sets of calculations were made to examine a possible business-as-usual (BAU) scenario, the policy implementation scenario and an examination of the incremental growth between these two scenarios. As noted previously it is highly uncertain that the rate of recycling growth can or will continue. To be clear, the increase of 5.4 MMTCO2e is above baseline levels from Year 2000 such that if BAU rates can continue the incremental GHG reduction in 2020 will be 2.19, indicating that additional measures and efforts are still required to achieve the goal. These values are displayed in Table 2.

Economic data for this analysis was taken from *Increased Recycling Economic Information Study Update: Delaware, Maine, Massachusetts, New York and Pennsylvania Final Report 2009.* This report provides for residential and commercial costs of collection and revenues as well as, tonnages of material recycled. This data reflects collected survey data from numerous establishments in Pennsylvania representing urban and rural communities with widely divergent populations. This data served as the basis for the costs and cost-effectiveness data displayed in Table 2. Annual rate of discounting of 5percent was applied to the net costs. The net present value for the policy scenario is a savings of approximately $119 per ton of CO_2e reduced and the difference between BAU and the policy scenario is a net present value of $82. The cost-effectiveness of this initiative is a savings of $6.22 per ton of CO_2e.

This analysis does not include an assessment of the indirect and induced economic benefits realized by recycling but these are significant. A 2009 study, "Recycling Economic Information Study Update," prepared for the Northeast Recycling Council, Incorporated indicates that as of 2007, PA had 3,800 establishments involved in some aspect of recycling, employing a work force of more than 52,000 with an annual payroll of approximately $2.2 million and revenues of nearly $21 million.

Table 2. Costs and Cost-effectiveness

	2013	2014	2015	2016	2017	2018	2019	2020
BAU Tons Recycled	4,328,724	4,347,840	4,366,957	4,428,026	4,489,095	4,550,164	4,611,233	4,672,302
Policy Tons Recycled	4,576,489	4,678,194	4,779,899	4,923,557	5,067,214	5,210,872	5,354,529	5,498,187
Incremental Tons Recycled	247,765	330,354	412,942	495,531	578,119	660,708	743,296	825,885
BAU GHG Reduced (MMtCO2e)	11.28	11.44	11.60	11.77	11.93	12.09	12.25	12.42
Policy GHG Reduced (MMtCO2e)	11.94	12.32	12.70	13.08	13.46	13.85	14.23	14.61
Incremental GHG Reduction (MMtCO2e)	0.66	0.88	1.10	1.32	1.54	1.76	1.98	2.19
BAU Collection Cost ($ million)	219.83	220.81	221.78	224.88	227.98	231.08	234.18	237.28
Policy Collection Cost ($ million)	232.42	237.58	242.75	250.04	257.34	264.63	271.93	279.23
Incremental Collection Cost ($ million)	12.58	16.78	20.97	25.17	29.36	33.55	37.75	41.94
BAU Recycling Revenue($ million)	339.42	340.91	342.41	347.20	351.99	356.78	361.57	366.36
Policy Recycling Revenue ($ million)	358.84	366.82	374.79	386.06	397.32	408.58	419.85	431.11
Incremental Recycling Revenue ($ million)	19.43	25.90	32.38	38.85	45.33	51.81	58.28	64.76
BAU Net Cost ($ million)	(119.58)	(120.11)	(120.64)	(122.32)	(124.01)	(125.70)	(127.39)	(129.07)
Policy Net Cost ($ million)	(126.43)	(129.24)	(132.04)	(136.01)	(139.98)	(143.95)	(147.92)	(151.89)
Incremental Net Cost ($ million)	(6.84)	(9.13)	(11.41)	(13.69)	(15.97)	(18.25)	(20.53)	(22.82)
BAU Discounted Net Cost ($ million)	(102.53)	(97.83)	(93.35)	(89.92)	(86.60)	(83.39)	(80.28)	(77.28)
Policy Discounted Net Cost ($ million)	(108.39)	(105.26)	(102.17)	(99.98)	(97.75)	(95.50)	(93.23)	(90.94)
Incremental Discounted Net Cost ($ million)	(5.87)	(7.43)	(8.83)	(10.06)	(11.15)	(12.11)	(12.94)	(13.66)

Implementation Steps:
To achieve the goal of this initiative it is suggested efforts could target specific materials that provide maximum GHG reductions, as illustrated in Table 1. Specific recommendations also include:

1. Ensure that the state government is taking a leadership role and maximizing recycling efforts. These efforts will include ensuring compliance with the comprehensive management directive that all commonwealth agencies, boards and commissions implement recycling and waste reduction programs, as well as purchase environmentally preferable products. PA DEP will promptly review the annual reports from GSA regarding the status of compliance with the directive, and will take appropriate measures to ensure future compliance.

2. Encourage county governments to report recycling activities within their jurisdiction, as required by Act 101. To facilitate more timely and improved reporting PA DEP has procured a new reporting system to capture much of the recycling data that currently goes unreported. PA DEP will conduct regular and comprehensive audits of the data to ensure accuracy and consistency, and shall promptly make the information available for review on the Department’s website. The data shall distinguish between recycled material quantities from residential and non-residential sources, as well as the amounts of materials managed by single stream processing.

3. *Municipal Government Recycling Programs*—Assist in working to amend Act 101 to require recycling programs for municipalities with a lesser density than currently stated in the Act, and

with smaller populations than the 5,000 in the current Act. PA DEP should consider proposing the new limits, and adding high concentration facilities, such as airports and shopping malls, and arenas, stadiums and concert halls seating 3,000 or more people and offering food or drink service. Seek ways to encourage all municipal recycling programs to include all plastic and paper types in a list that should be developed by PA DEP. This would logically include all types of plastic and paper that have a market potential and/or sorting convenience to home owners—e.g., generally co-mingled materials that do not required confusing requirements for acceptable versus unacceptable materials. PA DEP should evaluate existing recycling programs and assist municipalities to identify steps to improve recycling services, such as endorsement of more encompassing or efficient collection processes and consolidation or elimination of redundant, out-dated or non-sustainable recycling facilities.

4. *Public Recycling Availability*—PA DEP should consider establishing rules on density and availability of recycling containers for all public areas in which waste disposal receptacles are placed, including high concentration facilities, such as airports and shopping malls, and arenas, stadiums and concert halls seating 3,000 or more people and offering food or drink service. This should be in the form of guidelines for municipal recycling programs and state governmental agencies. Appropriate language can be incorporated into the Act 101 amendments.

Funding through Act 101— In light of the reduction in fees generated for the Recycling Fund, the DEP should become more discerning in how those funds are utilized. The department should encourage more encompassing and efficient collection processes, provide greater incentive to those programs and processes that demonstrate improved recycling performance, provide expansion of recycling to high concentration events and facilities, and consolidation or elimination of redundant, outdated, or non-sustainable recycling operations.

5. Conduct a comprehensive review of all the current legislation to identify areas where legislation creates obstacles or impediments to the management and beneficial use of waste material.

6. Develop a strategy to focus on expanding recycling programs to:
   a. Support and grow recycling industries.
   b. Eliminate barriers that impede the use of waste for energy production.
   c. Support the growth of private-sector recycling programs by leveling the playing field between government-supported and private-sector programs.
   d. Ensure financial support to protect past investments in recycling programs.
   e. Promote new private-sector investments and protect past private-sector investments in LFGTE projects and similar programs.
   f. Ensure adequate funding to facilitate a sophisticated and robust statewide recycling program for all commonwealth citizens.

7. Assist in developing a single legislative package for consideration that folds all previously enacted legislation under one comprehensive package. The resulting package should include assisting in recycling at the source of generation, encouraging market development, and limiting disposal of recyclable materials at the end.

Potential Overlap:
- Waste-to-Energy MSW

Subcommittee Comments:
This work plan was substantially revised from the version originally supplied by the department. With these changes the subcommittee members felt that meaningful reductions could be accomplished in a cost effective manner, based on the assumptions in the work plan.