

Expanding Recycling in Michigan:

An Update

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Prepared for
Michigan Recycling Partnership

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Background

In April 2006, Public Sector Consultants (PSC) released a report prepared for the Michigan Recycling Partnership (MRP) titled “Expanding Recycling in Michigan.” The report provided a summary of Michigan’s municipal solid waste (MSW) recycling performance while identifying and summarizing model state recycling programs and quantifying the benefits of increased recycling. The key points of the 2006 report were as follows:

Michigan’s economy benefits greatly from recycling

- Michigan has an estimated 2,242 establishments in the recycling and reuse industry with receipts of \$11.6 billion, a payroll of about \$2.06 billion, and employment of 61,700. The industry generates about \$490 million in state and local taxes.
- Including indirect and induced economic activity, the recycling industry in the state is responsible for 164,122 jobs with a payroll of about \$4.8 billion and receipts of \$19.8 billion.

Increasing recycling in Michigan enhances that benefit

- Increasing recycling in Michigan from 20 percent (2002 estimate) to the Great Lakes states average of 30 percent would create between 6,810 and 12,986 jobs. This addition of jobs would generate \$155 to \$300 million in income, \$1.8 to \$3.9 billion in receipts, and about \$12 to \$22 million in state taxes.
- Given Michigan’s job prospects, unemployment rate, and economic outlook, capturing the economic benefits provided by increased recycling should be made a priority for the state.

The public supports and is willing to pay for increased recycling

- Polling of Michigan residents indicates overwhelming support for a comprehensive recycling program within the state (90 percent were “very” or “somewhat” likely to support such a program).

Michigan is woefully behind other states in recycling efforts

- Michigan’s statewide and per capita recycling rate of 20 percent and 0.38 tons/year/person, respectively, are lower than the other Great Lakes states (30 percent/0.44) and the U.S. (27 percent/0.46) averages.
- Michigan does not collect or mandate the reporting of MSW recycling data, unlike many other states. This lack of information gathering means the state is unable to measure its recycling performance (i.e., its handling, collection, transport, and marketing of recyclable materials).
- Michigan’s recycling program is funded at a fraction of the level of other Great Lakes states’ programs and ranks 41st out of 48 states that reported their allocations for recycling.
- Only 37 percent of Michigan residents have access to curbside recycling, the lowest percentage of all the states in the region.

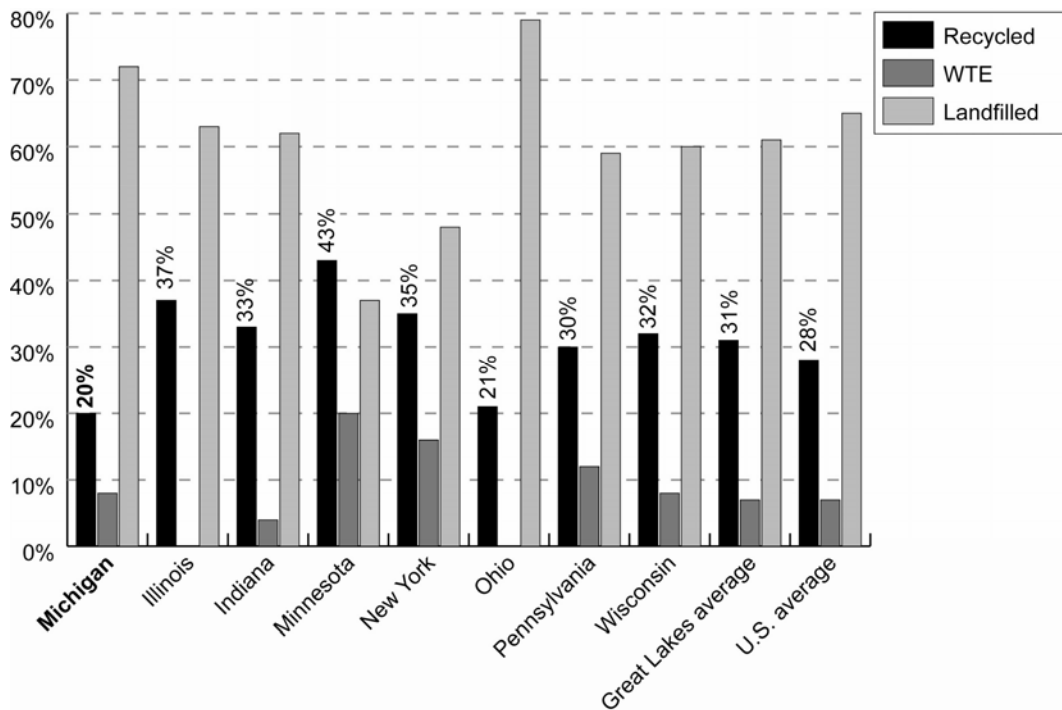
- Michigan has not invested in developing or sustaining markets for recycled materials, and some businesses have to import recycled materials from other states because of the inconsistency in local supplies.

Michigan's Recycling Performance

Michigan's recycling rate continues to be the lowest among the eight Great Lakes states (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin), and is much lower than the national average. According to *BioCycle's* 2008 "State of Garbage in America" report, which is based on 2006 municipal solid waste (MSW) tonnage data, the Great Lakes region's performance is comparable to the rest of the nation. The U.S. generates 413 million tons of MSW per year, and of that, 28.6 percent is recycled, 6.9 percent is combusted in waste-to-energy plants (WTE), and 64.5 percent is landfilled. The eight Great Lakes states combine for a ratio of 31 percent/7 percent/61 percent (recycled/WTE/landfilled). Minnesota posts the highest rates of both recycling and converted waste to energy (43 and 20 percent, respectively), and conversely has the lowest rate of landfilling (37 percent). Michigan has the lowest rate of recycling (20 percent) and the second highest rate of landfilling (72 percent) among the Great Lakes states (Exhibit 1).

EXHIBIT 1

Percentage of Municipal Solid Waste Recycled, Combusted (Waste to Energy), and Landfilled, 2006* Estimates



SOURCE: Recycling data from *BioCycle* magazine's "State of Garbage in America" December 2008 report. Great Lakes region calculations by Public Sector Consultants Inc.

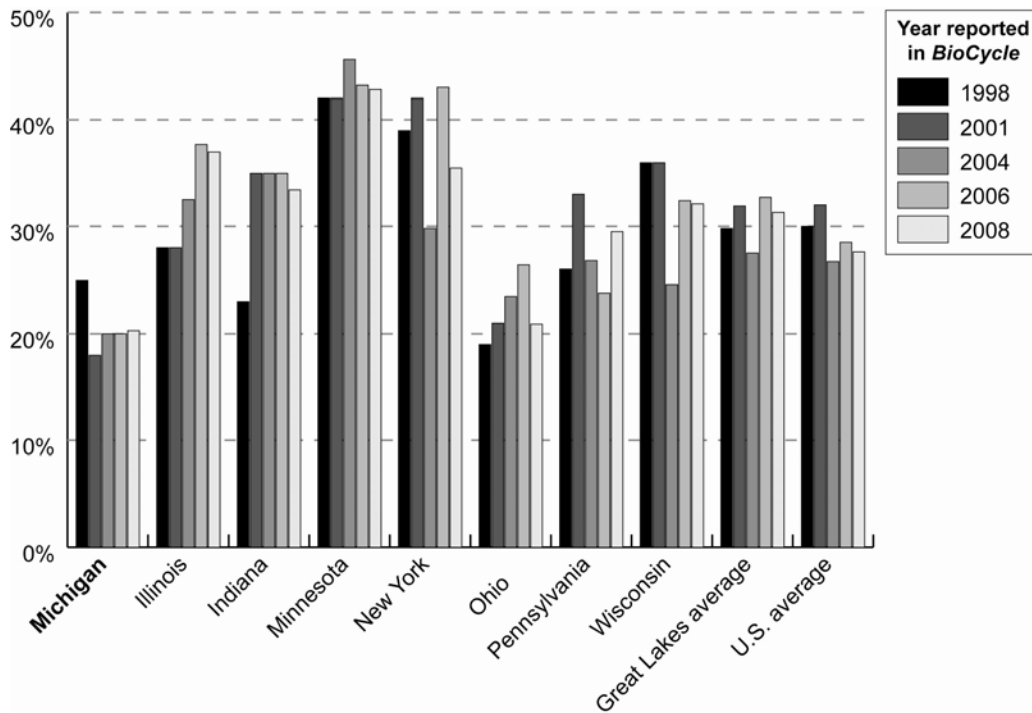
*Data for most of the states are from 2006, except Indiana and Michigan (2004 data) and Pennsylvania (2005 data).

NOTES: These figures are percentages of the estimated MSW generated for each state. Estimated MSW generated is computed from reported tonnages of: [Landfill + Exported Landfill + WTE + Exported WTE + MSW Recycled] – [Construction and Demolition Debris Landfill + Industrial Landfill + Imported Landfill + Imported WTE]. Landfill includes the residential and commercial waste streams, organics, tires, and "other." The January 2004 issue of *BioCycle* reported a 15.1 percent recycling rate for Michigan. However, *BioCycle* later recognized this as a misprint and corrected it in the February 2004 issue to reflect the recycling rate of 20 percent, which was calculated by the Michigan Recycling Coalition (MRC).

Recycling Trend Analysis

Year-to-year comparisons among the states are somewhat difficult to make because the data reported by each state are somewhat varied in terms of collection methodology and time period covered. Exhibit 2 displays the reported recycling rates of the eight Great Lakes states from *BioCycle* magazine's "State of Garbage in America" in 1998, 2001, 2004, 2006, and 2008. The data are based on various years from 1996 to 2006. Although many states reported peak recycling rates in previous years and those rates have since dropped, most states (other than Michigan, New York, and Wisconsin) experienced growth in their recycling rates from 1998 to 2004. Indiana has shown the greatest growth in reported recycling, from 23 percent in 1998 (second to last among the eight states) to 33 percent (fourth) in 2008, a 43 percent increase. Conversely, Michigan's reported recycling rate from 1998 to 2008 has dropped 20 percent (Exhibit 2).

EXHIBIT 2
Recycling Rates in Great Lakes States, Selected Years



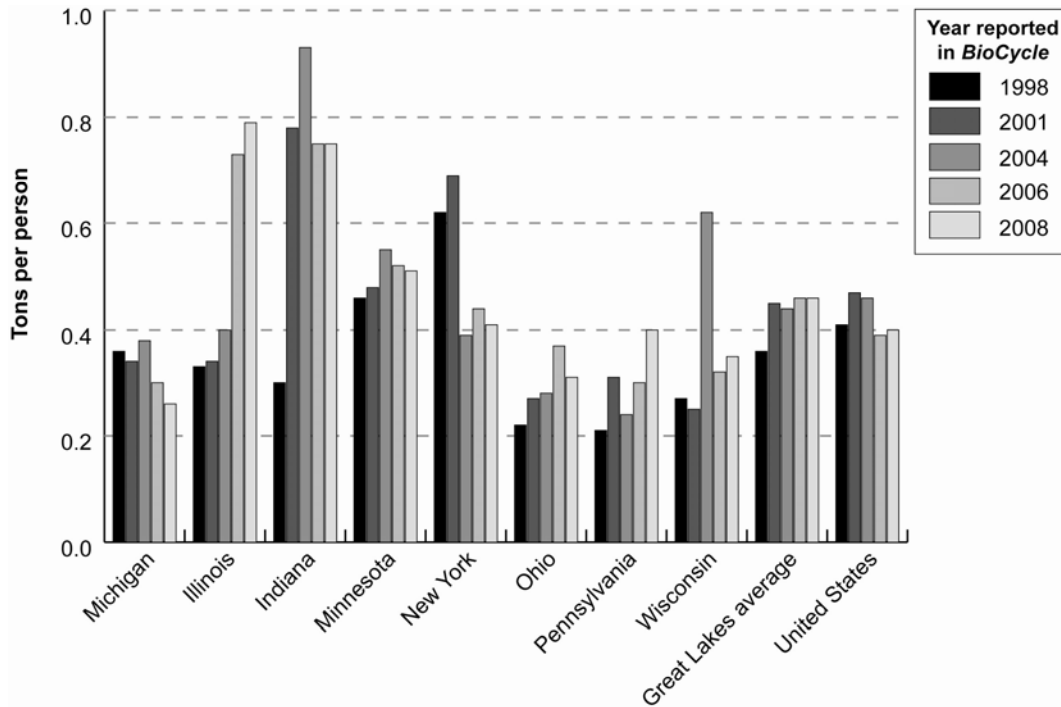
SOURCE: *BioCycle* magazine's "State of Garbage in America" reports from April 1998, December 2001, January 2004, April 2006, and December 2008.

NOTE: The January 2004 issue of *BioCycle* reported a 15.1 percent recycling rate for Michigan. However, *BioCycle* later recognized this as a misprint and corrected it in the February 2004 issue to reflect the recycling rate of 20 percent, which was calculated by the MRC and is Michigan's most recent estimate.

Given the recycling rate, the Census population figures, and the total MSW generated, one can calculate the amount of MSW recycled on a per capita basis (see Exhibit 3). Michigan is the poorest performer in per capita recycling at 0.26 tons/year/person. Six of the eight Great Lakes states saw increases on a per capita basis in the last 10 years, including the best performing state, Indiana, whose residents increased their recycling rate by 150 percent (0.30 to 0.75 tons/yr/person). Michigan's per capita recycling rate

decreased by 28 percent (0.36 to 0.26 tons/yr/person). Michigan's rate is below the regional and national average for per capita recycling across time.

EXHIBIT 3
Per Capita Recycling in Great Lakes States, Selected Years



SOURCE: Recycling data from *BioCycle* magazine's "State of Garbage in America" reports from April 1998, December 2001, January 2004, April 2006, and December 2008.
 NOTES: 1998 state population data from 1990 Census. 2001, 2004, 2006, and 2008 state population data from 2000 census. Per capita recycling rate based on reported MSW generated multiplied by the recycling rate, then divided by actual Census population or population estimate for data year.

Statewide Public Survey Data

A statewide telephone survey of comprehensive statewide recycling and funding to support was conducted in 2009 by Marketing Resource Group.¹ The survey sampled 600 residents across Michigan and had a standard error of ± 4.1 percent. The five important results from the survey were:

- The majority of residents (88 percent) had some form of recycling in their community but only 59 percent of the respondents indicated that they participated in recycling (not counting bottles).
- Four main reasons given by respondents for not recycling more were the fees/cost associated with recycling (29 percent), lack of availability (21 percent), that recycling was too complicated (18 percent), and that they were too busy to recycle (16 percent).
- Almost three-quarters of respondents (72 percent) believe that Michigan is doing a fair to excellent job in the recycling arena and 81 percent somewhat or strongly support a comprehensive recycling program in the state. However, support dropped to 56 percent when respondents were asked about funding a comprehensive recycling program. When further questioned about their own willingness to fund a comprehensive recycling program, the level of support fell further to 42 percent.
- Almost half (49 percent) of the respondents strongly support the idea of a penny fee on retail transactions to fund a statewide comprehensive recycling effort; 31 percent strongly support a 13-cent deposit (consumers would get 10 cents back); and 29 percent strongly support a tipping fee surcharge. Among the three choices the transaction fee was the overwhelming favorite of the respondents, who preferred it by a ratio of more than 2:1 over the other two choices.
- 81 percent of the respondents agree to the statement that recycling is important and needs to be offered even if there is a cost to consumers. However, 61 percent believe that the current economic climate is not conducive to passing additional costs on to consumers.

The survey data highlight the many obstacles that need to be overcome in order to increase the statewide recycling rate. Availability of recycling in a community doesn't ensure that individuals will recycle; they also need to be educated on the importance of recycling. Sub-populations that express the opinion that recycling is too complicated or that they are too busy to recycle make a perfect audience to target a message on the simplicity and rewards of recycling. A statewide comprehensive recycling effort is unlikely to gain traction unless viable funding streams are identified. The public is supportive of comprehensive recycling in spirit but the challenging economic times may hinder this support in reality.

¹ Summary of Statewide Polling: Comprehensive Statewide Recycling and Funding to Support. Received from the MRP on April 10, 2009. Survey conducted by Marketing Resource Group.

Recycling Impacts on Greenhouse Gas Emissions in Michigan

It should be no surprise that recycling provides social and economic benefits to society across varying scales (e.g., local, national, and global). These benefits include:²

- Increased U.S. competitiveness and an expansion in manufacturing sector jobs
- Decreased dependence on landfills and incineration
- Decreased pollution from the use of already made materials compared to virgin materials
- Increased energy savings
- Lowering of greenhouse gas emissions that contribute to global warming
- Conservation of natural resources such as wood, water, and minerals
- Environmental protection for future generations
- Increased health and aesthetic benefits

One of the major benefits of recycling is savings in greenhouse gas (GHG) emissions. The increased attention to global warming and GHG in recent years has made the recycling effort more important than ever because it can have a substantial impact on lowering GHG emissions. At a national level, the 85 million tons of municipal solid waste that Americans recycled in 2007 reduced carbon dioxide emissions by 193 million metric tons.³ This equates to removing 35 million passenger cars from roads.

The objectives of this section of the report are to determine the impact of recycling on GHG emissions in Michigan. Specifically, the following will be evaluated:

- The GHG emission reductions due to recycling in Michigan (which has a 20 percent recycling rate)
- The additional GHG emission reductions possible if Michigan's recycling rate of 20 percent was increased to the Great Lakes average of 31 percent

Estimating GHG Emission Reductions Due to Recycling in Michigan

GHG emission reductions from recycling are calculated by multiplying the quantity of materials recycled (by material type) by each type's GHG emission factor. The Environmental Protection Agency (EPA) has already calculated GHG emission factors by material type, and these are shown in Exhibit 4. Unfortunately, calculating GHG emission reductions for Michigan is a challenge because Michigan does not collect data on quantity of materials recycled, nor does it break down recycled materials by material type.

² "Puzzled About Recycling's Value? Look beyond the Bin." 1998. U.S. EPA document. Page 1.

³ "Municipal Solid Waste in the United States. 2007." U.S. EPA document. Page 16.

EXHIBIT 4
Net Reduction in GHG Emissions from Recycling (MTCE/Ton)*

Material	Recycling
Glass	-0.08
Paper	-0.96
Construction & Demolition (C&D)	0.00
Steel	-0.49
Plastic	-0.56
Aluminum	-3.70
Other Metals	-1.43
Wood	-0.67
Tires	-0.50
Organics	0.00
Other	-0.32

SOURCE: "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks." 2006. 3rd edition of EPA report. Modified from Exhibit ES-4 data. Page ES-14.

*MTCE/Ton: Metric tons of carbon equivalent per short ton of material. Material tonnages are on an as-managed (wet weight) basis.

NOTE: The net reduction in GHG emissions due to recycling plastic is an average of the reduction attributed to three types of plastic (high-density polyethylene [HDPE], low-density polyethylene [LDPE], and polyethylene [PET]). Net reductions in GHG emissions due to recycling C & D and Organics is zero (EPA data did not have an estimate for these categories). Net reduction in GHG emissions due to recycling all other materials is an average of GHG reductions for each category based on EPA data.

Some states do track tons of material recycled by type, though, so PSC identified among these states those that are in the Great Lakes region because of their regional and population similarities to Michigan. Through *BioCycle's* 2008 "State of Garbage in America" report, five of the eight Great Lakes states (Minnesota, New York, Ohio, Pennsylvania, and Wisconsin) collect and report this data. To use this information to estimate Michigan's recycling stream composition; PSC had to first convert the data, which is reported in tons of material recycled, to percentage composition within each category. This was done by dividing the tonnage of reported material within each category by the total tonnage of all recycled materials. Exhibit 5 shows the results of this calculation.

EXHIBIT 5
Composition of Recycled Materials for Reporting Great Lakes States

Material	Minnesota	Ohio	New York	Pennsylvania	Wisconsin	Great Lakes average
Glass	4.55%	1.14%	2.69%	1.09%	5.36%	2.96%
Paper	34.71	29.16	21.01	10.57	47.66	28.63
C&D	No data	No data	50.99	7.68	2.38	20.35
Steel	0.92	11.61	11.15	0.36	1.34	5.08
Plastic	1.78	1.24	1.66	1.07	1.52	1.45
Aluminum	0.92	3.53	0.49	0.90	0.41	1.25
Other Metals	15.14	0.14	No data	20.14	0.89%	9.08
Wood	3.87	5.49	0.57	3.62	No data	3.39
Tires	0.69	3.02	0.32	0.94	1.63	1.32

Material	Minnesota	Ohio	New York	Pennsylvania	Wisconsin	Great Lakes average
Organics	6.67%	37.15%	6.91%	10.58%	27.82%	17.82%
Other	30.75	7.52	4.22	43.04	10.98	19.30

SOURCE: Recycling data from *BioCycle* magazine's "State of Garbage in America" December 2008 report. Percentage conversions by PSC.

NOTE: When a Great Lakes state did not report on the recycled material tonnage within a particular category the percentage composition for the Great Lakes states average was based on data from the states that did report.

PSC used the material composition data above as a proxy to estimate Michigan's composition, which as stated above is necessary to calculate GHG emission reductions. This was done by multiplying the percentage composition within a category (Exhibit 5) by the total MSW recycled in Michigan, which is 2,594,940 tons/year.³ For example, based on Ohio's composition of glass we get 1.14 percent * 2,594,940 = 29,484 tons of recycled glass in Michigan. Exhibit 6 shows the results of using this method with percentage composition data from Ohio, Minnesota, and the Great Lakes average. Ohio and Minnesota were used because they are the states with the lowest and highest recycling rate, respectively. Using percentage composition data as a proxy for Michigan for these states, as well as the average for the five Great Lakes states for which data are available, provide a realistic range of possible composition tonnages for Michigan.

EXHIBIT 6

Michigan Estimates for Tons of Recycled Materials Based on Three Different Percentage Compositions

Material	Ohio-based estimate	Minnesota-based estimate	Great Lakes average-based estimate
Glass	29,484	118,118	76,931
Paper	756,812	900,806	742,829
C&D	No data	No data	528,081
Steel	301,266	23,936	131,736
Plastic	32,150	46,219	37,739
Aluminum	91,502	23,936	32,452
Other Metals	3,553	392,784	235,540
Wood	142,439	100,308	87,864
Tires	78,482	18,012	34,292
Organics	964,006	172,957	462,535
Other	195,247	797,864	500,855

SOURCE: Computed data based on state compositions from *BioCycle* magazine's "State of Garbage in America" December 2008 report. Calculations by PSC.

NOTE: Data can be arrived at by multiplying percent compositions (Exhibit 5) by the total amount of MSW recycled in Michigan in 2006 (2,594,940 tons).

Having calculated the tonnage of recycled materials within different categories, the next step is to calculate the net savings in GHG emissions. This can be accomplished by

³ Total MSW recycled in Michigan is calculated by multiplying the states recycling rate of 20 percent by the total MSW generated (12,768,089 tons), which equals 2,594,940 tons/year. Data is from *BioCycle*'s 2008 "State of Garbage in America" report.

multiplying the estimated tons of recycled materials in Michigan (estimates in Exhibit 6) by the assumed net reduction in GHG emissions (Exhibit 4) to determine the total potential net reduction in metric tons of carbon dioxide emissions (Exhibit 7). Recycling paper leads to the greatest volume of savings in GHG emissions. An important observation is the savings in GHG emissions from aluminum. The GHG emission savings of using recycled aluminum is 3.7 MTCE/ton, so even a small amount of recycled aluminum can have a substantial impact on GHG emissions. Using Ohio aluminum composition of 3.53 percent results in an estimated 338,556 metric tons of GHG emission savings in Michigan. Recycling of other metals also contributes to major savings in GHG emissions. It should be noted that even though C&D and organics are recycled their GHG emissions savings is zero. The range of GHG emission savings in Michigan is between 1,434, 412 metric tons and 1,889,925 metric tons of carbon dioxide annually.

EXHIBIT 7

Michigan Estimates for Total Reductions in GHG Emissions from Recycling (MTCE/Ton)* Based on Estimated Tons of Recycled Materials for Three Different Percentage Compositions

Material	Ohio-based estimate	Minnesota-based estimate	Great Lakes average-based estimate
Glass	2,359	9,449	6,154
Paper	726,539	864,774	713,116
C&D	0	0	0
Steel	147,620	11,729	64,550
Plastic	18,004	25,883	21,134
Aluminum	338,556	88,563	120,071
Other Metals	5,081	561,681	336,823
Wood	95,434	67,206	58,869
Tires	39,241	9,006	17,146
Organics	0	0	0
Other	61,578	251,634	157,962
Total	1,434,412	1,889,925	1,495,825

SOURCE: Computed data based on state compositions from *BioCycle* magazine's "State of Garbage in America" December 2008 report and "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks." 2006. 3rd edition of EPA report. Modified from Exhibit ES-4 data. Page ES-14. Calculations by PSC.

*MTCE/Ton: Metric tons of carbon equivalent per short ton of material. Material tonnages are on an as-managed (wet weight) basis.

A reduction in GHG emissions measured in terms of metric tons of carbon dioxide saved is one possible unit of analysis. This metric of savings (metric tons of carbon dioxide) can also be translated into other measures of savings. By using the total values generated in Exhibit 7 we can use the Greenhouse Gas Equivalencies Calculator⁴ (GHGEC) to estimate equivalent metrics of GHG emission savings in Michigan (see Exhibit 8).

⁴ Greenhouse Gas Equivalencies Calculator. 2009. U.S. Environmental Protection Agency. <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>. Accessed March 27, 2009.

EXHIBIT 8**Michigan Estimate for Total Reductions in GHG Emissions and Its Equivalencies
under Three Different Percentage Compositions**

GHG savings metric	Ohio-based estimate	Minnesota- based estimate	Great Lakes average-based estimate
Total reduction in metric tons of carbon dioxide	1,434,412	1,889,925	1,495,825
Fewer passenger vehicles on road	262,713	346,140	273,961
Gallons of gasoline saved	162,816,459	214,520,318	169,787,174
Barrels of oil saved	3,335,844	4,395,172	3,478,663
Number of homes powered by electricity savings (per year)	198,948	262,125	207,465
Number of homes with energy demands met (per year)	130,520	171,968	136,108
Acres of forest preserved from deforestation	10,005	13,182	10,433

SOURCE: Derived by PSC using the GHG Equivalency Calculator. U.S. Environmental Protection Agency. 2009.
<http://www.epa.gov/cleanenergy/energy-resources/calculator.html>.

Estimating GHG Emission Reductions for Michigan with Increased Recycling

If Michigan were to increase its recycling rate to the Great Lakes average, 31 percent, the amount of GHG emission reductions could be even greater. To quantify the increase, PSC used the same method described above. First, PSC used percentage composition data for Ohio, Minnesota, and the Great Lakes average (Exhibit 5) to estimate Michigan's recycling stream composition based on a 31 percent recycling rate (rather than the current 20 percent rate used above to estimate *current* GHG emission reductions). This was done by multiplying the percentage composition within a category (Exhibit 5) by the total MSW recycled in Michigan, which under a 31 percent recycling rate scenario is 3,993,138 tons/year.⁵ The results of this calculation are shown in Exhibit 9.

⁵ Total MSW recycled in Michigan based on the Great Lake's average of 31 percent is calculated by multiplying this recycling rate by the total MSW generated (12,768,089 tons), which equals 3,993,138 tons/year. Data is from *BioCycle's* 2008 "State of Garbage in America" report.

EXHIBIT 9

Michigan Estimate for Tons of Recycled Materials for Three Different Percentage Compositions at 31 Percent Recycling Rate (Great Lakes Average)

Material	Ohio-based estimate	Minnesota-based estimate	Great Lakes average-based estimate
Glass	45,371	181,762	118,383
Paper	1,164,595	1,386,176	1,143,079
C&D	0	0	812,620
Steel	463,593	36,833	202,717
Plastic	49,473	71,122	58,074
Aluminum	140,804	36,833	49,937
Other Metals	5,468	604,423	362,454
Wood	219,187	154,355	135,206
Tires	120,769	27,718	52,768
Organics	1,483,428	266,150	711,757
Other	300,450	1,227,767	770,724

SOURCE: Computed data based on state compositions from *BioCycle* magazine's "State of Garbage in America" December 2008 report. Calculations by PSC.

NOTE: Data can be arrived at by multiplying percent compositions (Exhibit 5) by the total amount of estimated MSW recycled in Michigan based on a 31 percent average (3,993,138 tons).

The next step is to multiply the estimated tons of recycled materials in Michigan (estimates in Exhibit 9) by the assumed net reduction in GHG emissions (Exhibit 4) to determine the total potential net reduction in metric tons of carbon dioxide emissions (Exhibit 10) under the increased Great Lakes average recycling rate of 31 percent.

EXHIBIT 10

Michigan Estimate for Total Reductions in GHG Emissions from Recycling (MTCE/Ton)* Based on Estimated Tons of Recycled Materials for Three Different Percentage Compositions at 31 Percent Recycling Rate

Material	Ohio-based estimate	Minnesota-based estimate	Great Lakes average-based estimate
Glass	3,630	14,541	9,471
Paper	1,118,011	1,330,729	1,097,356
C&D	0	0	0
Steel	227,161	18,048	99,331
Plastic	27,705	39,828	32,521
Aluminum	520,976	136,282	184,768
Other Metals	7,819	864,324	518,309
Wood	146,855	103,418	90,588

Material	Ohio-based estimate	Minnesota-based estimate	Great Lakes average-based estimate
Tires	60,385	13,859	26,384
Organics	0	0	0
Other	94,757	387,219	243,074
Total	2,207,299	2,908,248	2,301,802

SOURCE: Computed data based on state compositions from *BioCycle* magazine's "State of Garbage in America" December 2008 report and "Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks." 2006. 3rd edition. Calc Tons of Recycled Materials for Three Different Percentage Compositions at 20 Percent Recycling Rate. Calculations by PSC.

*MTCE/Ton: Metric tons of carbon equivalent per short ton of material. Material tonnages are on an as-managed (wet weight) basis.

Based on the increased recycling rate, PSC used the total values generated in Exhibit 10 to calculate GHG emission savings under other metrics. The three composition totals were used as input values in the GHGEC to estimate equivalent potential reductions in other elements that contribute to GHG emissions (see Exhibit 11).

EXHIBIT 11

Michigan Estimate for Total Reductions in GHG Emissions and its Equivalencies under Three Different Percentage Compositions at 31 Percent Recycling Rate

GHG savings metric	Ohio-based estimate	Minnesota-based estimate	Great Lakes average-based estimate
Total Reduction in metric tons of carbon dioxide	2,207,299	2,908,248	2,301,802
Fewer passenger vehicles on road	404,267	532,646	421,575
Gallons of gasoline saved	250,544,722	330,107,605	261,271,510
Barrels of oil saved	5,133,253	6,763,367	5,353,028
Number of homes powered by electricity savings (per year)	306,144	403,363	319,251
Number of homes with energy demands met (per year)	200,846	264,627	209,445
Acres of forest preserved from deforestation	15,396	20,285	16,055

SOURCE: Derived by PSC using the GHG Equivalency Calculator. U.S. Environmental Protection Agency. 2009. <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>.

Having calculated the total reductions in GHG emissions under a 20 percent and 31 percent recycling rate we can determine the savings in GHG emissions that would be realized by the increased recycling rate. This is accomplished by subtracting total savings in GHG emissions at a 20 percent recycling rate from total savings in GHG emissions at a 31 percent recycling rate (Exhibit 12). Increasing the recycling rate from the current Michigan rate of 20 percent to the Great Lakes states average of 31 percent is estimated to decrease annual carbon dioxide emissions by at least 772,886 metric tons and up to 1,018,324 metric tons. This is equivalent to at least 141,554 fewer cars on the road, over 87 million gallons of annual gasoline savings, electricity savings to power more than

100,000 homes, energy savings to meet the energy demands for more than 70,000 homes, or more than 5,000 acres of forest preserved from deforestation.

EXHIBIT 12

Michigan Estimate for GHG Emission Reductions and Its Equivalencies if Michigan's Recycling Rate Increased from 20 Percent to 31 Percent, under Three Different Compositions

GHG savings metric	Ohio-based estimate	Minnesota-based estimate	Great Lakes average-based estimate
Difference between a 31% and 20% recycling rate (metric tons of carbon dioxide)	772,886	1,018,324	805,977
Fewer passenger vehicles on road	141,554	186,506	147,614
Gallons of gasoline saved	87,728,263	115,587,287	91,484,336
Barrels of oil saved	1,797,409	2,368,195	1,874,365
Number of homes powered by electricity savings (per year)	107,196	141,238	111,786
Number of homes with energy demands met (per year)	70,326	92,659	73,337
Acres of forest preserved from deforestation	5,391	7,103	5,622

SOURCE: Derived by PSC using the GHG Equivalency Calculator. U.S. Environmental Protection Agency. 2009. <http://www.epa.gov/cleanenergy/energy-resources/calculator.html>.

Summary of Results and Discussion

An increase in the recycling rate by 1 percent leads to approximately 70,000 metric tons of carbon dioxide (equivalent to eight million gallons of gasoline) being prevented from reaching the earth's atmosphere. PSC estimates that recycling in Michigan currently leads to annual reductions of at least 1,434,412 metric tons of carbon dioxide. This reduction in GHG emissions is equivalent to more than 260,000 fewer passenger vehicles on the road, more than 160 million gallons of gasoline saved, annual electricity savings to power almost 200,000 homes, annual energy savings to meet the demands of more than 130,000 homes, or more than 10,000 acres of forest preserved from deforestation. The implications of setting higher targets for recycling rates are energy independence and protecting national security interests by increasing reliance on internal production. It is not unreasonable to state that what is good for recycling is good for America.

Increasing the recycling rate from the current Michigan rate of 20 percent to the Great Lakes states average of 31 percent is estimated to decrease annual carbon dioxide emissions by at least 772,886 metric tons and up to 1,018,324 metric tons. This is equivalent to at least 141,554 fewer cars on the road, over 87 million gallons of annual gasoline savings, electricity savings to power more than 100,000 homes, energy savings to meet the energy demands for more than 70,000 homes, or more than 5,000 acres of forest preserved from deforestation.

If Michigan were to increase its recycling rate to the Great Lakes average of 31 percent, estimated annual reductions in carbon dioxide would be at least 2,207,299 metric tons.

This reduction in GHG is equivalent to more than 400,000 fewer passenger vehicles on the road, more than 250 million gallons of gasoline saved annually, annual electricity savings to power more than 300,000 homes, annual energy savings to meet the demands of more than 200,000 homes, or more than 15,000 acres of forest preserved from deforestation.

One other significant point to emerge from the GHG analysis is that in addition to the recycling rate, the composition of the different recycled materials has an impact on emissions. When recycled, aluminum, other metals, and paper provide the maximum positive impact on GHG emission savings. Recycling one ton of aluminum saves 3.7 metric tons of carbon dioxide from being released into the atmosphere. By ensuring that the maximum amount of aluminum, other metals, and paper collected from MSW in Michigan is recycled, governments at all levels across the state can ensure that the citizens are receiving the societal benefits of maximal GHG reductions.