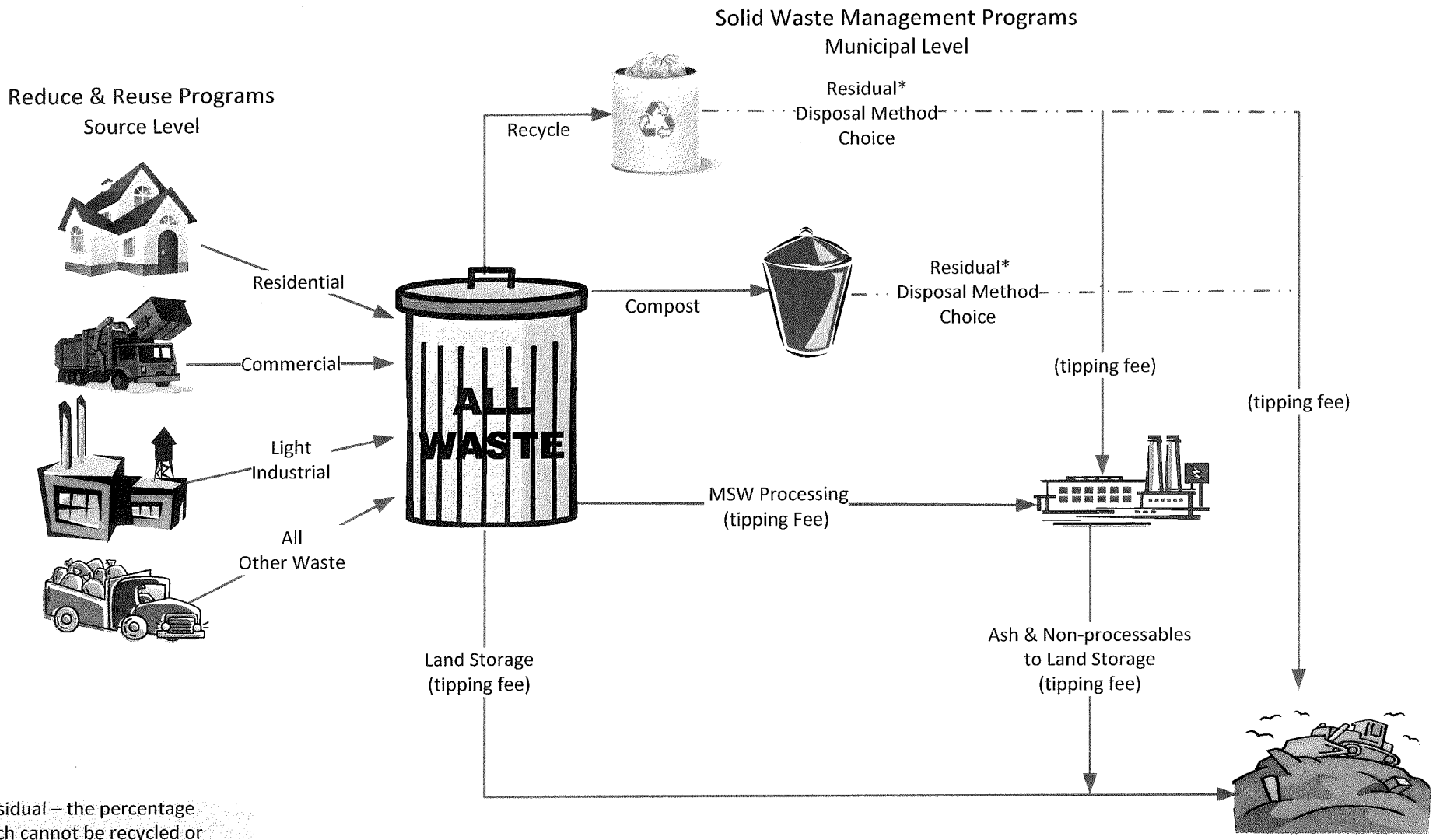
Maine's Solid Waste Hierarchy
Good Public Policy



*Residual – the percentage which cannot be recycled or composted but can be taken to a Waste to Energy facility or Landfill Storage site.

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Waste Management & Recycling Program

Waste Management Hierarchy

In 2009 it was calculated that Maine residents and businesses generated just over 1.7 million tons of trash - which amounts to about 7.3 pounds of garbage produced by each person each day. This is nearly 2,600 pounds of trash per person per year! Maine's solid waste management hierarchy is a priority list of how we should appropriately deal with all of this waste, with the goal of reducing the amount of waste needing to be landfilled. This hierarchy was adopted by the Maine Legislature in 1989.

For more information on the hierarchy and the policy click here: MRSA 38 §2101

Maine's Hierarchy from highest to lowest priority:

Reduce
The best way to deal with trash is to not have any! Reducing the amount of trash you have to throw out actually prevents waste from piling up in the first place. To reduce your waste, avoid unnecessary packaging and items designed to be used only once. Reduce the need for 'single use' plastic bags by bringing your own bags when you shop, and use a travel mug when you buy coffee. Choose durable, reusable products to make less trash.

Reuse
Reusing items saves a lot of energy and money. Extend the life of items you buy by reusing them. For example, reuse containers and jars, and donate still usable household goods and clothing to charity.

Recycle
Every day we use products made from recycled materials. Take your glass, cans, newspapers, milk jugs and other acceptable recyclable items to your local transfer station or curbside collection so that they can be turned into new products like fleece jackets, Frisbees, cars, and soda cans. Recycling saves money, energy, and the environment. 38.7% of Maine's municipal solid waste was recycled in 2009.

Compost
Composting is nature's way of recycling.
When you compost, you convert vegetable scraps, leaves, grass clippings and other materials into a nutrient rich soil material. You can use finished compost in your garden and

Contact Waste Management & Recycling

FACEBOOK

TWITTER

Quick Links

Composting Information

Recycling & Solid Waste Data

Maine Recycles Campaign

Maine Recycles Week

Juniper Ridge Landfill

Household Hazardous Waste

Promote Recycling in Your Community

around shrubs or other plants to help them grow. Composting also reduces the amount of materials that need to be landfilled.

Waste-To-Energy

Waste-to-Energy facilities accept our solid waste and combust it very high temperatures producing heat that is used to convert water into steam. The steam is used to run turbines to generate electricity. Scrubbers, filters, and other pollution control equipment reduce pollutants released during the incineration process. Ash and other residues are landfilled. Over 33% of Maine's garbage was combusted in 2009.

Landfill

Today's landfills are very different from the old ones where people just dumped their garbage in an open area. Landfills are constructed and operated to strict environmental standards, including liners to protect groundwater. Within this hierarchy, landfills are the last of the various solid waste management options that should be considered.

Text as a Word document (157KB)

ECONOMIC CONTRIBUTION AND FISCAL IMPACT OF MAINE'S WASTE-TO-ENERGY SECTOR

April 2013

Todd Gabe, Ph.D.[1]

Commissioned by:
USA Energy Group, LLC

This study shows the following:

- ⇨ Maine's waste-to-energy (WTE) sector currently has three facilities that employ 149 workers and provide $13.1 million in labor income annually (not including the closed Maine Energy Recovery Company—MERC).
- ⇨ Including multiplier effects, the three WTE facilities have an annual statewide economic contribution of an estimated $101.1 million in revenue, 404 full- and part-time jobs, and $23.4 million in labor income.
- ⇨ In 2011, Maine and its municipalities received an estimated $13.2 million in taxes and fees due to the economic activity associated with the three remaining WTE facilities.
- ⇨ The WTE sector's state and local fiscal impact—that is, taxes and fees—will average an estimated $15.8 million per year between 2011 and 2029.
- ⇨ If Maine's three remaining WTE facilities were to close and the waste they process were instead stored in landfills, the state and its municipalities would lose an estimated $12.6 million in taxes and fees per year, on average, between 2011 and 2029.

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[1] Todd Gabe (todd.gabe@yahoo.com) is a Professor of Economics at the University of Maine. This study was conducted under a private consulting contract with USA Energy Group, LLC, which is a partner in the Penobscot Energy Recovery Company—PERC.

ECONOMIC CONTRIBUTION AND FISCAL IMPACT OF MAINE'S WASTE-TO-ENERGY SECTOR

1) INTRODUCTION

Prior to the closure of Maine Energy Recovery Company (MERC) in Biddeford, there were four waste-to-energy (WTE) facilities in Maine—the other three, still operating, are ecomaine in Portland, Mid-Maine Waste Action Corporation (MMWAC) in Auburn, and Penobscot Energy Recovery Company (PERC) in Orrington. These companies produce electricity using municipal and commercial solid waste. As of 2010, the four WTE facilities—including MERC—collectively processed approximately 830,000 tons of waste per year and produced approximately 474,700 MWhs/yr of electricity.[2] Maine is one of 24 states with a waste-to-energy sector and, as of 2010 when it had four plants, Maine ranked 9th nationally (of these 24 states) in terms of the number of WTE facilities and 11th nationally in terms of "trash capacity" per day.[3]

Waste-to-energy is a large component of Maine's overall waste management capacity. According to a 2011 report by the Maine Governor's Office of Energy Independence and Security, the four WTE facilities processed approximately 75 percent of the municipal solid waste generated in the state. The facilities served over 290 Maine municipalities with a

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2 These figures are from an April 2011 report, titled "Waste to Energy Power," by the State of Maine Governor's Office of Energy Independence and Security. Industry-wide statistics have not been updated by the state to reflect the recent closure of MERC.

3 These figures are from a U.S. Energy Recovery Council report, titled "The 2010 ERC Directory of Waste-to-Energy Plants."

combined population of approximately 961,500 people.[4] This population figure, applied to the total state population of 1,328,361, suggests that over 70 percent of Maine's population was served—as of 2010—by one of the state's WTE facilities.[5]

The purpose of this study is to analyze the statewide economic contribution and fiscal impacts of Maine's waste-to-energy sector, as it is currently structured, as well as the effects of a proposed municipal revenue sharing plan for disposal of municipal solid waste at WTE facilities. For the purposes of this study, "Economic Contribution" is defined as the revenue, employment (i.e., full- and part-time jobs) and labor income (i.e., wages, salaries and benefits) that are directly associated with the three WTE facilities, as well as the multiplier effects supported by the purchases of businesses (indirect impacts) and workers (induced impacts). "Fiscal Impact" is defined as the state and local taxes and government fees that are directly associated with the WTE sector and its workers, as well as the taxes / fees paid by businesses and workers that are incorporated in the multiplier effects. Results presented in the report are based on industry figures published in an October 2011 report, titled "Statewide Economic Contribution of Maine's Waste-to-Energy Sector," and additional information specific to PERC's operations that was

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4 These figures are from an April 2011 report, titled "Waste to Energy Power," by the State of Maine Governor's Office of Energy Independence and Security. A 2012 report, titled "Solid Waste Generation & Disposal Capacity Report," by the Maine State Planning Office shows that—for the year 2010—waste-to-energy made up 33.2 percent of Maine's "solid waste management methods." Recycling accounted for the largest share of waste disposal in the Maine State Planning Office report; however, the share associated with waste-to-energy is 1.3 times larger than the share of waste that is landfilled.

5 The Maine state population figure is from the U.S. Census Bureau.

provided by USA Energy Group (USAE), Inc.[6] An input-output (IMPLAN) model of the Maine economy is used to estimate the WTE sector's state and local fiscal impacts, as well as the multiplier effects in the analysis of its economic contribution.

Table 1 summarizes the revenue, employment and labor income that are directly associated with the three WTE facilities in Maine. The facilities range in annual revenue from a low of $6.3 million (MMWAC) to a high of $40 million (PERC). PERC is the largest of Maine's three WTE facilities in terms of revenue, employment and labor income. In total, the Maine WTE sector has an annual direct economic contribution of $69.9 million in revenue, 149 full- and part-time jobs, and $13.1 million in labor income. The relatively high average wages and salaries paid to workers directly employed by Maine's WTE facilities ($88,106 per worker) are a reflection of high productivity (i.e., output per worker) and the specialized technical and/or business skills required to work in the industry.[7]

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6 Gabe, Todd. "Statewide Economic Contribution of Maine's Waste-to-Energy Sector," consulting report prepared for the Maine Waste-to-Energy Working Group, October 2011. Similar information on Maine's waste-to-energy sector is presented in an April 2011 *Waste-to-Energy Power* report by the Governor's Office of Energy Independence and Security.

7 According to 2010 data from the U.S. Bureau of Labor Statistics, the "total average compensation" per job in Maine was $48,416, which is considerably lower than the average payroll per worker in the waste-to-energy sector. Data from the 2011 National Compensation Survey of the U.S. Bureau of Labor Statistics show that 64 percent, 69 percent and 58 percent of U.S. workers employed in private companies have access to retirement, medical care and life insurance benefits, respectively. Maine's WTE facilities typically provide comprehensive benefits to their workers.

Table 1. Overview of Maine's Waste-to-Energy Sector

Facility	Location		Annual Revenue	Employment	Labor Income
Currently in operation:					
ecomaine	Portland		$23,563,700	46	$4,179,800
Mid-Maine Waste Action Corporation (MMWAC)	Auburn		$6,313,849	28	$2,448,023
Penobscot Energy Recovery Company (PERC)	Orrington		$40,000,000	75	$6,500,000
		Total	$69,877,549	149	$13,127,823
Discontinued operations:					
Maine Energy Recovery Company (MERC)	Biddeford		$23,506,562	79	$6,409,669

Source: "Statewide Economic Contribution of Maine's Waste-to-Energy Sector," October 2011.

2) ECONOMIC IMPACT ANALYSIS

a) Economic Impact of Maine's Waste-To-Energy Sector

Table 2 presents results on the statewide economic contribution of Maine's WTE sector. The industry's "direct impact" is the annual revenue, employment and labor income associated with the three facilities, as shown in Table 1.

Table 2. Statewide Annual Economic Contribution of Maine's WTE Sector (three facilities)

	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Revenue	$69,877,549	$17,133,267	$14,072,591	$101,083,407
Employment	149	128	127	404
Labor Income	$13,127,823	$5,401,327	$4,856,896	$23,386,046

Notes: Direct revenue, employment and labor income figures are from the report, "Statewide Economic Contribution of Maine's Waste-to-Energy Sector," October 2011. Multiplier effects were estimated using an economic impact (IMPLAN) model of the Maine economy. The economic impact analysis is revised, compared to the 2011 report, to account for the closure of MERC.

The indirect and induced impacts, collectively referred to as the "multiplier effects," are the additional revenue, employment and labor income in Maine that are supported by the purchases of businesses (i.e., indirect) and workers (i.e., induced) that are impacted by the WTE sector. The IMPLAN model, used to estimate the multiplier effects, is an input-output framework that traces the flows of expenditures and income through the Maine economy with a complex system of accounts that are uniquely tailored

to the state.[8] Underlying these accounts is information regarding transactions occurring among industries located in Maine, the spending patterns of households, and transactions occurring between the state and the rest of the world. Some of the data sources used to develop the IMPLAN model and tailor it to the Maine economy include County Business Patterns of the U.S. Census Bureau, Regional Economic Information System (REIS) data and input-output accounts from the U.S. Bureau of Economic Analysis, and ES-202 statistics from the U.S. Bureau of Labor Statistics.

Including multiplier effects, the Maine waste-to-energy industry has an annual statewide economic contribution of an estimated $101.1 million in revenue, 404 full- and part-time jobs, and $23.4 million in labor income.[9] These figures indicate that the workers directly and indirectly impacted by the WTE sector earn an average of $57,886 in labor income per year. As noted above, the individuals directly employed by the WTE facilities earn an average of $88,106 per worker (labor income divided by employment in Table 1)—an amount that reflects the high productivity and technical nature of the industry's labor demands. The workers employed outside of the three facilities (i.e.,

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8 Version 3.0 of the IMPLAN model has information on 440 sectors of the economy. The WTE industry is classified in the economic impact analysis as a "hybrid" of the IMPLAN sectors "Electric Power Generation, Transmission and Distribution" and "Waste Management and Remediation Services." The exact weights applied to these IMPLAN sectors are determined using the direct impact figures shown in Table 1.

9 The employment figures in the IMPLAN model are based on a headcount and do not differentiate between full and part-time workers. The labor income figures in IMPLAN include wages and salaries, as well as employer-paid benefits.

supported by the purchases of businesses and workers related to the WTE sector) earn an average of $40,228 in labor income per year.[10]

The revenue multiplier of 1.45, defined as the ratio of total revenue ($101.1 million) to direct revenue ($69.9 million), suggests that every $1.00 of revenue in the industry supports a total of $1.45 in statewide economic activity; that is, the "initial" $1.00 in revenue plus an additional $0.45. The employment multiplier of 2.71, calculated as the ratio of total (404 jobs) to direct (149 jobs) employment, suggests that the economic activity associated with each person directly employed in the WTE industry supports a total of 2.71 Maine jobs; that is, the person in one of the state's three WTE facilities and an additional 1.71 full- or part-time jobs elsewhere in the state.[11]

To put these figures into perspective, Table 3 shows a list of statewide employment multipliers by major (i.e., 2 digit NAICS) industrial category. The size of an industry's employment multiplier depends on—among other factors—the amount of revenue generated per worker (i.e., high productivity increases the employment multiplier), the extent to which the industry purchases goods and services produced in Maine (i.e., more in-state purchases increases the employment multiplier), and the full- versus part-time nature of employment in the industry (i.e., sectors with more part-time workers have lower employment multipliers). In the case of Maine's WTE sector, the

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10 This average labor income figure of $40,228 is estimated by the Maine IMPLAN model. The average labor income of workers inside the WTE facilities ($88,106) and outside of the facilities ($40,228) are used to estimate the average labor income of workers directly and indirectly impacted by the WTE sector ($57,886).

11 A 2009 study ("The Existing and Potential Economic Impact of the Energy-from-Waste Industry in Florida") by Thomas Conoscenti found that every direct job in the Florida WTE sector would support an additional 1.30 jobs elsewhere in the state. This employment multiplier of 2.30 for Florida is lower than the statewide employment multiplier of 2.71 estimated for the Maine WTE sector.

relatively large employment multiplier of 2.71 is explained, in part, by the high productivity of workers directly employed by the facilities (e.g., average revenue of $468,977 per worker).

Table 3. Maine Statewide Employment Multipliers by 2-Digit NAICS Category

NAICS Category	Industry Description	Employment Multiplier
	Waste-to-Energy Sector	2.71
31-33	Manufacturing	2.66
22	Utilities	2.61
52	Finance and Insurance	2.35
51	Information	2.22
55	Management of Companies and Enterprises	2.22
42	Wholesale Trade	1.96
53	Real Estate and Rental and Leasing	1.82
21	Mining, Quarrying, and Oil and Gas Extraction	1.8
48-49	Transportation and Warehousing	1.74
54	Professional, Scientific, and Technical Services	1.69
62	Health Care and Social Assistance	1.66
23	Construction	1.64
56	Administrative and Support and Waste Management and Remediation Services	1.44
11	Agriculture, Forestry, Fishing and Hunting	1.44
61	Educational Services	1.42
81	Other Services (except Public Administration)	1.39
71	Arts, Entertainment, and Recreation	1.37
72	Accommodation and Food Services	1.37
44-45	Retail Trade	1.29

Notes: Figures are from the report, "Statewide Economic Contribution of Maine's Waste-to-Energy Sector," October 2011. The employment multiplier for the WTE sector is revised to account for the closure of MERC.

Although employment multipliers vary across individual sectors within the major industrial categories, the WTE sector has an employment multiplier that is slightly higher than those estimated by the IMPLAN model for the broadly-defined Manufacturing (also characterized by high amounts of revenue per worker) and Utilities sectors. The employment multiplier estimated for the WTE sector is considerably larger than the multipliers for Retail and Wholesale Trade, and several of the service-related major industrial categories (e.g., Educational Services, Healthcare and Social Assistance, Administrative and Support and Waste Management and Remediation Services).

b) Economic Impact of PERC

Table 4 presents results on the statewide economic contribution of Penobscot Energy Recovery Company. PERC is analyzed separately from the other two WTE facilities in order to determine the relative magnitude of its impact compared to that of the entire sector. This information is used in the next section when examining the fiscal impacts of the entire WTE sector in Maine. Including multiplier effects, Penobscot Energy Recovery Company has an annual statewide economic contribution of an estimated $55.7 million in revenue, 208 full- and part-time jobs, and $11.6 million in labor income. Comparing the total revenue figures from Table 2 ($101.1 million) and Table 4 ($55.7 million), we see that the entire WTE sector's economic contribution is 1.81 times larger than the economic contribution associated with PERC.

Table 4. Statewide Annual Economic Contribution of PERC

	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Revenue	$40,000,000	$7,804,600	$7,908,557	$55,713,157
Employment	75	61	72	208
Labor Income	$6,500,000	$2,422,310	$2,689,522	$11,611,832

Notes: Direct revenue, employment and labor income figures were provided by PERC. Multiplier effects were estimated using an economic impact (IMPLAN) model of the Maine economy.

3) FISCAL IMPACT ANALYSIS

a) Fiscal Impact of Maine's Waste-To-Energy Sector

Table 5 shows results on the state and local fiscal impacts of Maine's waste-to-energy sector. As defined earlier in the report, "fiscal impacts" are the state and local taxes and government fees that are directly associated with the WTE sector and its workers, as well as the taxes / fees paid by businesses and workers that are incorporated in the industry's multiplier effects. Industry-level fiscal impact figures are based on estimates for PERC, which are described below. The fiscal impacts estimated for PERC are adjusted by a factor of 1.81 because this is the ratio of the sector's total economic contribution relative to that of PERC. The WTE sector's fiscal impacts starting in 2018 are, thus, 1.81 times larger than the fiscal impacts associated with PERC.[12] The fiscal impacts include a wide range of state and local government revenue sources, such as—

[12] This ratio is slightly lower in earlier years due to PERC's Purchased Power Contract with Bangor Hydro Electric, scheduled to end in February 2018, which does not affect the other two WTE facilities in Maine.

but not limited to—income taxes, sales taxes, property taxes, and various fees and assessments. Results indicate that Maine's three WTE facilities generated an estimated state and local fiscal impact of $13.2 million in 2011, with an average fiscal impact of $15.8 million per year between 2011 and 2029.

Table 5. Fiscal Impact of Maine's Waste-to-Energy Sector, 2011 to 2029

	State and Local Taxes / Fees
2011	$13,200,250
2012	$13,567,445
2013	$13,944,855
2014	$14,332,763
2015	$14,731,462
2016	$15,141,252
2017	$15,562,440
2018	$14,301,193
2019	$14,699,013
2020	$15,107,900
2021	$15,528,161
2022	$15,960,113
2023	$16,404,080
2024	$16,860,398
2025	$17,329,409
2026	$17,811,466
2027	$18,306,933
2028	$18,816,183
2029	$19,339,598
Average	$15,839,206

Notes: Industry-wide fiscal impacts are based on estimates for PERC (see Table 6), which are adjusted using the ratio of the sector's total economic contribution (see Table 2) relative to PERC's total economic contribution (see Table 4).

Table 6. Fiscal Impact of PERC, 2011 to 2029

	State and Local Taxes / Fees
2011	$7,902,980
2012	$8,122,820
2013	$8,348,775
2014	$8,581,015
2015	$8,819,716
2016	$9,065,056
2017	$9,317,222
2018	$7,882,249
2019	$8,101,512
2020	$8,326,874
2021	$8,558,505
2022	$8,796,580
2023	$9,041,277
2024	$9,292,781
2025	$9,551,281
2026	$9,816,972
2027	$10,090,054
2028	$10,370,732
2029	$10,659,218
Average	$8,981,348

Notes: Fiscal impacts are based on information from a variety of sources (see footnote 13) and tax and government fee estimates generated by the Maine IMPLAN model.

b) Fiscal Impact of PERC

Table 6 displays information on the fiscal impacts of PERC, upon which the results for the entire WTE sector are based. The 2011 state and local fiscal impact figure of $7.9 million represents the estimated amount of revenue received by Maine and its municipalities based on PERC's total economic contribution and related financial activity. For most of the tax and government fee categories, the exact estimates generated by the Maine IMPLAN model are used. In a few cases, the tax estimates are calculated

"outside the model" and these figures replace those generated by IMPLAN.[13] This is done to capture PERC's unique ownership structure and the company's Purchased Power Contract with Bangor Hydro Electric. These types of financial details—specific to PERC—are not built into the IMPLAN model, which is calibrated using more general industry-level data for Maine and the overall U.S. economy.

Information on the growth of the U.S. Consumer Price Index (CPI) between 2002 and 2011 is used to calculate an inflation rate to adjust the fiscal impact estimates for the years 2012 to 2017 and—separately—for the years 2018 to 2029. The calculated inflation rate is 2.78 percent, which is fairly modest by historical standards. Annual CPI growth averaged 3.35 percent between 1913 and 2011, and the rate of inflation exceeded 2.78 percent in 53.1 percent of the years over this period. Between 2011 and 2029, PERC will have an average estimated fiscal impact of $9.0 million per year.[14]

Table 7. Reduction in Taxes and Fees if Three Remaining WTE Facilities were to Close

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13 The figures estimated "outside the model" are based on information provided by Penobscot Energy Recovery Company (i.e., USA Energy Group, LLC), and other sources such as the annual reports of Bangor Hydro Electric and the Maine Public Utilities Commission.

14 The reduction in PERC's fiscal impact between 2017 and 2018 is explained by the expiration of PERC's Purchased Power Contract, which will lower the facility's return on investment and terminate the stranded costs recovered by Bangor Hydro Electric along with their associated taxes and government fees. The difference between the contracted rate with PERC and the market rate for electricity is one component of the stranded costs recovered by Bangor Hydro Electric. Other components include assets and liabilities associated with Maine Yankee decommissioning, Hydro-Quebec, Seabrook investment, and the costs of restructuring the Purchased Power Contract with PERC. An article in the Bangor Daily News from 2011 notes that, "75 percent of Bangor Hydro's stranded costs are related to a 1984 contract with Penobscot Energy Recovery Company." Wickenheiser, Matt. "Hearing on Bangor Hydro rate request set for Thursday," *Bangor Daily News*, March 15, 2011.

	Reduction in State and Local Taxes / Fees
2011	$11,130,684
2012	$11,440,309
2013	$11,758,548
2014	$12,085,639
2015	$12,421,829
2016	$12,767,371
2017	$13,122,525
2018	$11,042,499
2019	$11,349,671
2020	$11,665,388
2021	$11,989,888
2022	$12,323,414
2023	$12,666,219
2024	$13,018,559
2025	$13,380,700
2026	$13,752,915
2027	$14,135,484
2028	$14,528,695
2029	$14,932,844
Average	$12,605,957

Notes: Figures are based on the fiscal impact results presented in Table 5, adjusted to account for the estimated additional state and local taxes / fees associated with an increase—required if the WTE facilities were to close—in the amount of waste stored in Maine landfills.

c) Impact on Taxes and Fees if WTE Facilities were to Close

Table 7 presents information on the estimated reduction in state and local taxes / fees if the three remaining WTE facilities were to close. The values differ from those presented in Table 5 because the waste processed by the three WTE facilities, if they were to close, would likely be sent to landfills in Maine. The figures shown in Table 7, therefore, start from the state and local taxes/fees related to the operations of the three WTE facilities and then account for the (offsetting) increase in government revenue

associated with the increase in waste stored in landfills.[15] After making these adjustments, the analysis shows that if Maine's three remaining WTE facilities were to close (and if the waste they process were stored in landfills), the state and its municipalities would lose an estimated $11.1 million to $14.9 million in taxes and fees per year between 2011 and 2029, with an average of $12.6 million.

4) PROPOSED SOLID WASTE STABILIZATION ACCOUNT

This section of the report describes aspects of LR 1172, which is "An Act to Promote and Enhance State Policy and Preserve and Support Existing Methods of Disposal of Municipal Solid Waste." The basic idea of LR 1172 is to establish a "solid waste stabilization account," which will make disbursements to municipalities and recycling/composting programs that qualify under provisions of the Act.[16] The amount of the disbursement is determined by the difference in the weighted average of the tipping fees paid per ton of stabilization solid waste to all licensed landfills in Maine and the weighted average tipping fees paid to all certified waste processing facilities, multiplied by the number of tons of waste processed by each certified waste processing facility.

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15 Information used in this analysis is from a 2012 report ("Solid Waste Generation & Capacity Report") by the Maine State Planning Office, a 2013 report ("Waste Generation and Disposal Capacity Report For Calendar Year 2011") by the Maine Department of Environmental Protection, landfill tipping fees from the websites listed in footnote 17, figures from County Business Patterns of the U.S. Census Bureau, and the Maine IMPLAN model. For example, the 2012 State Planning Office report suggests that landfills in Maine would experience an increase of an estimated 463,589 tons of solid waste if the three waste-to-energy facilities were to close.

16 Information in this section comes from LR 1172, co-sponsored by Senator Emily Cain and Representative Stephen Stanley.

One purpose of LR 1172 is to "level the playing field" between the tipping fees charged by landfills and those required by WTE facilities so as to help them remain financially healthy as well as continuing to support the State of Maine "waste hierarchy."[17] Waste-to-energy facilities typically charge higher tipping fees because it is more costly to process municipal solid waste, provide limited sorting and generate electricity from waste than it is to store waste in a landfill. Since (in the absence of "above market" electricity contracts) WTE companies are not able to cover their higher operating costs by increasing the price of the electricity they provide, WTE facilities are required to charge higher tipping fees than landfills.

For illustrative purposes, we estimate the difference in tipping fees for waste disposal between seven landfills in Maine and two waste-to-energy (WTE) facilities: ecomaine and Mid-Maine Waste Action Corporation (MMWAC). This analysis does not include Penobscot Energy Recovery Corporation (PERC) because it will not qualify, under provisions of LR 1172, to receive disbursements from the solid waste stabilization account until 2018—upon the expiration of its purchased power contract with Bangor Hydro Electric.

Based on landfill and WTE statistics from the 2013 report "Waste Generation and Disposal Capacity Report For Calendar Year 2011" by the Maine Department of Environmental Protection, as well as tipping fee and municipal assessment data from a variety of publicly-available sources, we estimate a (weighted average) difference in tipping fees (and municipal assessments) charged between the WTE facilities and

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17 According to the 2011 "Waste to Energy Power" report by the State of Maine Governor's Office of Energy Independence and Security, "energy recovery" is a more preferred waste management strategy than "treatment and disposal."

landfills in Maine of between $25.95 and $32.99 per ton of municipal solid waste.[18] This range increases to a difference of between $27.67 and $34.71 per ton if you exclude one of the landfills (an outlier), which has a published tipping fee that is over two times higher than the average of the other landfills included in the analysis. The midpoint of the low ($25.95) and high ($34.71) values reported above is $30.33 per ton, which is similar to the minimum disbursement amount ($30.00) used in LR 1172.

5) SUMMARY

After the recent closure of Maine Energy Recovery Company (MERC), there are currently three waste-to-energy facilities located in Maine: ecomaine in Portland, Mid-Maine Waste Action Corporation (MMWAC) in Auburn, and Penobscot Energy Recovery Company (PERC) in Orrington. These facilities directly support a combined

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18 The following websites and reports were used to estimate tipping fees and municipal assessments for Maine landfills and WTE facilities.

http://www.state.me.us/spo/recycle/docs/gencapdraft040110final.pdf

http://www.ecomaine.org/annualreport/2012%20Audit%20Financials.pdf

http://www.rumfordfallstimes.com/featured/story/tipping-fees-taking-tumble

http://www.augustamaine.gov/index.asp?Type=B_LIST&SEC=%7B2FBAB160-645D-41D4-92D3-3E33C78B068E%7D

http://ecomaine.org/annualreport/2012%20Annual%20Rpt.pdf

http://www.brunswickme.org/departments/public-works/landfill/

http://www.maine.gov/ag/dynld/documents/Solid_Waste_Report.pdf

http://www.cityofbath.com/recycling_pages_507_area68.html?m_id=517

http://www.presqueisle.govoffice2.com/index.asp?Type=B_BASIC&SEC={EA346C2B-6BA4-4B3F-9917-E46978D46DCA}

149 jobs, which provide $13.1 million in labor income (an average of $88,106 per worker). Results of an economic impact analysis show that, including multiplier effects, the Maine WTE sector has a total statewide economic contribution of an estimated $101.1 million in revenue, 404 full- and part-time jobs, and $23.4 million in labor income (an average of $57,886 per worker).

Along with their contribution to the Maine economy, the state's three WTE facilities generated a state and local fiscal impact—that is, taxes and government fees received by Maine and its municipalities—of an estimated $13.2 million in 2011, with an average fiscal impact of $15.8 million per year between 2011 and 2029. If Maine's three remaining WTE facilities were to close (and if the waste they process were instead stored in landfills), the state and its municipalities would lose an estimated $11.1 million to $14.9 million in taxes and fees per year between 2011 and 2029, with an average of $12.6 million.

Paying Now or Paying Later for Maine's Solid Waste Management

April 9, 2013

George Criner, Ph.D[1]

This report shows that:

1. Maine has roughly 400 closed landfills, and funding is not adequate to ensure public and environmental health. Millions of public Maine dollars have been spent on these landfills, and millions more will be needed to continue monitoring, maintaining, and fixing these closed landfills.
2. In addition, some of Maine's larger landfills are beginning to close and experts believe that the amount of public Maine dollars which will be needed to monitor, maintain and fix these landfills will increase significantly if action is not taken to reduce the volume of Maine-sourced and out-of-state-sourced solid waste deposited in Maine landfills. We have already seen formerly private Maine landfills become the financial responsibility of Maine citizens for closure, monitor and maintenance. One such landfill is currently polluting a tributary to the Penobscot River, and will cost the state millions of dollars for pollution containment.
3. While Maine has a Solid Waste Management Hierarchy with a goal of minimizing the portion of waste being landfilled, the hierarchy while environmentally progressive, lacks any a financial support structure of any manner.
4. Waste-to-Energy (WTE), the creation of energy from waste incineration, is preferred to landfilling in the Solid Waste Management Hierarchy. WTE reduces the volume of waste requiring landfilling, while at the same time generating electricity and creating good jobs and multiple tax revenues.
5. It is both geographically and politically challenging to find a suitable landfill location in Maine. Environmentally suitable landfill sites have been legislatively recognized in Maine as being "… in limited supply…" and representing "…a critical natural resource."
6. Without some public policy support structure, rather than being the least preferred destination for waste, landfills will likely become the first choice, with associated long-run financial, public health, and environmental risks. Under such a scenario, Maine avoids "paying now" and will "pay later".

[1] George Criner (crinerg@ymail.com) is a Professor of Economics, and Director of the School of Economics at the University of Maine. This study was conducted under a private consulting contract with USA Energy Group, LLC.

Maine's Landfills: Closing the Old-Style Dump/Landfills

Like many states in the nation, Maine historically relied mostly on town and city municipal landfills for solid waste disposal. Many of these landfills were nothing more than locations where garbage was dumped on the ground or in holes. These dumps had little or no engineering technology built into their structural design (such as plastic liners), or operation (such as covering trash daily with materials with reduce odor). A photo of one of these typical dumps/landfills is presented as Figure 1 in a January 23, 2012Maine report. [2] The photo caption is "A Typical 1960's Maine Landfill that Sparked Establishment of the Program" (p.4).

Following Federal encouragement, the Maine Legislature passed a series of laws which resulted in the near-term closure of these old-style dump/landfills which were posing an environmental and public health hazard. These old-style dumps/landfills, even when closed, will continue to pose environmental and public health hazards into the future. Senior Engineer and Geologist Robert G. Gerber,

[2] "Municipal Landfill Closure & Remediation Program: History and Future Program Requirements", Maine Department of Environmental Protection, January 23, 2012.
http://www.maine.gov/tools/whatsnew/attach.php?id=375207&an=1

with Andrews L. Tolman, outline a suggested decision tree for monitoring and maintaining these closed facilities. [3] Unfortunately, a review of the questions posed by Gerber and Tolman gives one a feel for the seriousness of the environmental and public dangers:[4]

1. Is the migration of landfill gas (an explosive) to buildings and basements possible,
2. Is part of the dump/landfill waste currently below the water table,
3. Is a Sand and Gravel Aquifer Affected?
4. Is the Landfill in a Deep Bedrock Recharge Area?
5. Will Water Supplies be Affected?
6. Are Sensitive Ecological Areas Affected?
7. Are Public Lands Affected?
8. Will the Landfill Discharge to Watersheds less than 10 Square Miles in Area?
9. Are there Possible Hazardous Wastes in the Landfill?

Maine's Landfills: State Financial Costs and Future Liability

In the closure of the nearly 400 old-style dump/landfills, the Maine DEP provided $79 million to municipalities between 1989 and 2000. The Maine DEP notes in their January 23, 2012 publication, that Maine's unfunded obligations to municipalities for additional needed landfill closure and remediation was estimated at just under $6.9 million. Unfortunately, these closed old-style dump/landfills will pose a virtually perpetual environmental, human health, and financial risk to Maine.

Unfortunately, these older 400 mostly municipal closed landfills are not the only landfills posing a risk in Maine. Maine's current modern landfills, with their engineered features including synthetic and clay liners, contrary to what some may believe, also pose a virtually perpetual environmental, human health, and financial risk to Maine.

The short non-technical explanation as to why a modern landfill poses environmental, human health, and financial risks is analogous to the following:

[3] http://info.ngwa.org/GWOL/pdf/940161580.PDF
[4] Numbers 3 through 9 are direct quotes from the Gerber/Tolman report, whereas 1 and 2 are paraphrased.

Imagine that you dig a hole in the ground and in the bottom and sides place several layers of clay and plastic. You then fill this hole with garbage – greatly overflowing into a mound. You then compact and re-fill until you have a rounded mound of dense garbage. Now you cover this mound with several layers of compacted clay and plastic.

Can anyone reasonably expect that this garbage will NEVER come into contact with anything besides the clay and plastic liners forever? Experts now recognize that the waste will not somehow become "safe" by mere burial. The garbage, or liquid from it, will eventually impact the environment. It may be 30, 100, 2000 or more years, but the liners will rupture or otherwise fail, and contaminants will be released into the environment. While some of these modern landfills may not fail within one or two human lifespans, the point is that the garbage isn't going anywhere, and human constructions, including landfills, will eventually fail.

A scientific discussion of long-run risks is provided below by G. Fred Lee, a noted expert in the science and engineering of landfills:[5]

Many permitted landfills in the US and some other countries are designed to just meet minimum US EPA Subtitle D prescriptive regulatory requirements for liners and covers. It has, however, been recognized in the technical literature and by US EPA staff for decades that the provisions of Subtitle D are inadequate at all locations to protect groundwater resources and public health from pollution by landfills for as long as the wastes will be a threat. Among other deficiencies, inadequate attention is given to the inevitable deterioration of the engineered systems, the inability to thoroughly and reliably inspect and repair system components, fundamental flaws in the monitoring systems allowed, the truly hazardous and otherwise deleterious nature of landfill gas and leachate, and the fact that as long as the wastes are kept dry, gas and leachate will not be generated. Subtitle D "dry-tomb" landfilling does not render buried wastes innocuous; at best, it only postpones groundwater pollution. Thus, meeting the minimal requirements of Subtitle D cannot be relied upon to prevent pollution for as long as the wastes represent a threat.

In another report, G. Fred Lee summarizes these issues with (p.5):[6]

[5] G. Fred Lee. Review of Potential Impacts of Landfills & Associated Postclosure Cost Issues, http://www.gfredlee.com/Landfills/Postclosure_Cost_Issues.pdf

In a dry tomb landfill the wastes will be a threat to generate leachate, effectively forever, and therefore are a threat to cause groundwater pollution well beyond the 30-year postclosure care period established in current landfilling regulations.

The prospect of Maine owning closed landfills (closed longer than 30 years) is not hard to imagine. Maine already owns the landfills Dolby I, II and III, with one or more being 30-plus years old. As seen in a Bangor Daily News article "Is East Millinocket's Dolby landfill the next Juniper Ridge?"[7]

State ownership of the landfill was critical to the eventual purchase of the two Katahdin region paper mills ...

Schneider said. "We may be becoming known as the 'dump state.' That is a huge concern to me. People in Maine in general are very environmentally conscious and aware. They want the state to be clean and certainly our big tourism industries don't want our branding to go down because we decide we are going to make Maine a landfill state."...

Maine Department of Environmental Protection officials don't see any immediate hazards, but they are concerned with the large amount of leachate — fluid generated when rainwater and snowmelt infiltrate waste — escaping the landfill, said Richard Heath, a senior environmental hydrogeologist for the DEP.

Some leachate contains several elements — bicarbonates, calcium, magnesium, sodium and potassium — that get into the nearby Partridge Brook Flowage at levels beyond those allowed by federal and state solid-waste standards, he said.

DEP scientists also see deteriorating groundwater quality at some routine monitoring wells on the property, including levels of arsenic that are as much as 30 times greater than allowed in federal drinking water standards ...

Maine Solid Waste Management Hierarchy

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[6] G. Fred Lee and Anne Jones-Lee. "Overview of Subtitle D Landfill Design, Operation, Closure and Postclosure Care Relative to Providing Public Health and Environmental Protection for as Long as the Wastes in the Landfill will be a Threat . http://www.gfredlee.com/Landfills/LFoverviewMSW.pdf

[7] http://bangordailynews.com/2011/12/09/news/state/is-east-millinocket's-dolby-landfill-the-next-juniper-ridge/ Posted Dec. 09, 2011, at 5:02 p.m., Last modified Dec. 09, 2011, at 5:36 p.m.

As there are no long term easy answers to the challenges of municipal solid waste disposal, it is essential that the State provide the leadership, management oversight and financial support for the existing overall waste disposal and processing system and Maine municipalities which today bear the greatest financial burden through the incurring of tipping fees and related costs associated with the disposal of municipal solid waste.

The State of Maine provided some guidance in 1989 with the adoption of a Maine Waste Management Hierarchy.[8] The policy notes that Maine's approach to MSW management should be integrated, implying that State recommendations and policies for one aspect of MSW should be in harmony with all other MSW aspects.

[8] http://maine.gov/spo/recycle/hierarchy/index.htm (see link to official statue citation).

Maine's Solid Waste Management Hierarchy from highest to lowest priority:

Reduce
The best way to deal with trash is to not have any! Reducing the amount of trash you have to throw out actually prevents waste from piling up in the first place. To reduce your waste, avoid unnecessary packaging and items designed to be used only once. Reduce the need for 'single use' plastic bags by bringing your own bags when you shop, and use a travel mug when you buy coffee. Choose durable, reusable products to make less trash.

Reuse
Reusing items saves a lot of energy and money. Extend the life of items you buy by reusing them. For example, reuse containers and jars, and donate still usable household goods and clothing to charity.

Recycle
Every day we use products made from recycled materials. Take your glass, cans, newspapers, milk jugs and other acceptable recyclable items to your local transfer station or curbside collection so that they can be turned into new products like fleece jackets, Frisbees, cars, and soda cans. Recycling saves money, energy, and the environment. 38.7% of Maine's municipal solid waste was recycled in 2009.

Compost
Composting is nature's way of recycling. When you compost, you convert vegetable scraps, leaves, grass clippings and other materials into a nutrient rich soil material. You can use finished compost in your garden and around shrubs or other plants to help them grow. Composting also reduces the amount of materials that need to be landfilled.

Waste-To-Energy
Waste-to-Energy facilities accept our solid waste and combust it very high temperatures producing heat that is used to convert water into steam. The steam is used to run turbines to generate electricity. Scrubbers, filters, and other pollution control equipment reduce pollutants released during the incineration process. Ash and other residues are landfilled. Over 33% of Maine's garbage was combusted in 2009.

Landfill
Today's landfills are very different from the old ones where people just dumped their garbage in an open area. Landfills are constructed and operated to strict environmental standards, including liners to protect groundwater. Within this hierarchy, landfills are the last of the various solid waste management options that should be considered.

First Priority to Reduce

The hierarchy lists as first priority the reduction of waste generated at the source, including both amount and toxicity of the waste. When a household composts its food waste in its backyard, this results in numerous economic and environmental

savings which may include one or several of the following: less energy (fuel and other) for hauling the food waste, lower consumer/municipal cost via less waste (e.g. buying fewer pay-as-you-throw garbage bag stickers), replacing purchased mulch with home-generated compost, and preserving landfill space. Considerable progress has also been made in reducing toxicity. For example, over time printer ink manufacturers have been moving away from toxic/hazardous inks to less toxic inks which are more water-based and soy-based. These efforts, source reduction and reduced toxicity, help reduce waste management costs very effectively and are thus at the top of the hierarchy.

Second Priority to Reuse

Reducing wastes is not always possible, so the second priority is to reuse items and materials when possible. Consider the reuse of water bottles which makes obvious economic and environmental sense – if one reuses a 12-ounce water bottle for drinking more water (by refilling it), the manufacturing, retailing, collection and disposal steps are eliminated for each reuse. The Food and Water Watch group estimates that in 2007, bottle water production and distribution in the U.S. used enough energy to fuel about 1.5 million cars for one year.[9] There are many other many other forms of reuse including gifting items to second hand stores, passing appliances and furniture on to others, and the reuse of shopping bags.

Third Priority to Recycling

If reducing and reusing is not possible or practical, the State's next priority is to recycle. Closed-loop recycling is when a product is recreated into the original product. For example, aluminum cans are recycled into new aluminum cans at a virtual one-for-one ratio, for virtual 100% closed-loop recycling. When paper is recycled, the paper fibers often damaged and broken, often requiring some new (virgin) paper fiber to added to the recycle mix. Since this recycling process results in less than a one-for-one recycling, this process is called open-loop recycling. Recycling requires collection and processing but generally saves electricity and landfill expenses and is thus given a hierarchy priority over waste-to-energy and landfilling.

[9] http://www.foodandwaterwatch.org/water/bottled/bottled-water-bad-for-people-and-the-environment/

Fourth Priority is Composting

The composting of biodegradable materials is the next highest priority after recycling. Composting, especially backyard and some municipal yard waste operations, are very low-technology requiring few inputs, and yield a useful soil amendment. Backyard composting has the potential to remove a larger fraction of Maine waste than most realize. Studies at the University of Maine have consistently shown that food waste is at least one-quarter of Maine residential "baggable" waste.[10] Efforts to compost more than leaf and yard waste, food and agricultural wastes have been met with challenges. Municipal solid waste contains toxic materials (e.g. pesticides, lead, mercury) and MSW composting operations have had difficulty producing a compost product that is economically useful, limited its use and creating issues of compost disposal. Larger composting operations also consistently have challenges with odor and sometime with runoff, thus limiting the long-run growth of this option.

Fifth Priority is Waste-To-Energy

Waste-to-Energy (WTE) facilities burn municipal solid waste under controlled conditions to generate electricity. The WTE process has the advantage of reducing incinerated waste 90%, and thus helping to preserve landfill space. Waste-to-Energy (WTE) facilities operate in harmony with high rates of recycling, create good jobs, and have less long-run environmental impacts compared to direct landfilling. The Maine statues explicitly note that waste processing, which "reduces volume of waste needing disposal", is preferred to landfilling.[11] The US Environmental Protection Agency also lists wastes-to-energy as preferable to landfilling.[12]

In addition to reducing the need for more landfills, WTE facilities also create more jobs per ton of trash than direct landfilling. As shown in the Dr. Todd Gabe report, the Maine WTE sector:

1. currently has three facilities that employ 149 workers and provide $13.1 million in labor income annually

[10] http://umaine.edu/wcs/files/2012/02/2011-Maine-Residential-Waste-Characterization-Study1.pdf
[11] http://www.mainelegislature.org/legis/statutes/38/title38sec1302.html
[12] (http://www.epa.gov/wastes/nonhaz/municipal/hierarchy.htm) Energy recovery from waste is the conversion of non-recyclable waste materials into useable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolization, anaerobic digestion, and landfill gas (LFG) recovery. This process is often called waste-to-energy (WTE).

2. including multiplier effects, the three WTE facilities have an annual statewide economic contribution of an estimated $101.1 million in revenue, 404 full- and part-time jobs, and $23.4 million in labor income.
3. Maine municipalities received an estimated $13.2 million in taxes and fees due to the economic activity associated with the three remaining WTE facilities.
4. The WTE sector's state and local fiscal impact—that is, taxes and fees—will average an estimated $15.8 million per year between 2011 and 2029.
5. If Maine's three remaining WTE facilities were to closed and the waste they process were instead stored in landfills, the state and its municipalities would lose an estimated $11.8 million in taxes and fees per year, on average, between 2011 and 2029.

Sixth and Least Preferred Priority is Landfilling

As listed in Maine solid waste management hierarchy, landfilling of waste is the least preferred option. There are many reasons why landfilling is a least preferred option. One important feature is that Maine is not geographically well-suited for landfills. The importance of suitable landfill sites is recognized as official State of Maine policy, as "The Legislature finds that environmentally suitable sites for waste disposal are in limited supply and represent a critical natural resource."[13]

In addition to geographical challenges associated with siting landfills in Maine, there are cost and social issues associated with landfill siting, construction and operation, and closure/postclosure. The siting of a new landfill is estimated to take eight years and is expensive. It is reasonable to assume that no new landfills will be sited in Maine without significant citizen and/or municipal challenges. These challenges, no matter what their basis, are costly and do temporary, if not long-lasting, damage to citizen and municipal well-being. In addition to the citizen unrest, there are documented studies showing the loss to property value from the presence of landfills. Searches of newspaper records show the hostile discourse associated with the State of Maine attempting to site a landfill in Hermon, Maine in the late 1980s, which followed a similarly heated attempt for the location of a private landfill at Maine's Township 30. New landfills cost millions of dollars to site with costs expected to continually increase into the future.

As was discussed earlier in this report, landfills are constructed primarily to store wastes. Maine, like many states, requires a postclosure period of only 30 year

[13] http://www.mainelegislature.org/legis/statutes/38/title38sec1302.html

postclosure period for landfills. As Dr. G. Fred Lee states, a 30 year postclosure period "has essentially no relationship to the period during which the wastes in the landfill will pose a threat to public health/welfare or environmental quality."[14]

Dr. G. Fred Lee is not an isolated case of a landfill engineer noting that the 30 year postclosure period is not realistic. Professional organizations also support a more realistic postclosure monitoring period ("post-closure care"). In a recent article "States and Industry Seek EPA Guidance on Long-Term Care of Landfills" state that:[15]

> *States and Industry groups are asking EPA to develop a national policy on how to manage closed hazardous and solid waste landfills past the 30-year post-closure care (PCC) period mandated by the Resource Conservation & Recovery Act (RCRA). It is becoming increasingly paramount for both regulators and site owners as landfills and other sites near the end of the PCC period. Both the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) and the Solid Waste Association of North America (SWANA) have issued reports calling for EPA guidance and saying states need criteria for determining when a site's PCC period should be extended or shortened, a possibility allowed for in RCRA regulation but which is not clearly defined. They say facility owners need to know what level of monitoring they should budget for during an extended PCC period, and also how to care for a site after the PCC period expires. Some states, including Minnesota and California, have developed their own approaches to the issue. That could result in a patchwork of inconsistent regulations which might not be scientifically grounded, the associations argue. ASTSWMO has recently issued a position paper asking for guidance on whether PCC periods should be adjusted when permits are renewed, and if so, what criteria should be used for making that determination, and also what length extension is appropriate.* See also: SWANA Seeks EPA Guidance for Long-Term Care of Landfills

[14] http://www.gfredlee.com/Landfills/Postclosure_Cost_Issues.pdf
[15] www.wastebusinessjournal.com/news/wbj20110823C.htm, August 22, 2011.

Conclusion: Maine Support for Waste-To-Energy is Part of the Solution

Since municipal solid waste management is complex, ever changing and expensive, it is prudent that municipalities make wise decisions. Further, the size of modern waste management systems including waste-to-energy facilities and landfills are such that single town owner-operations are no longer practical. Given the complexities and size of systems and facilities, it is prudent for State guidance. For example, under Maine Statute Title 38, Chapter 13, section 1302, it is noted that there has been "...diffused responsibility for municipal waste planning, processing and disposal among numerous and overlapping units of local government." This need for State leadership is seen within the statute language:[16]

> *The Legislature also finds that direct state action is needed to assist municipalities in separating, collecting, recycling and disposing of solid waste, and that sound environmental policy and economics of scale dictate a preference for public solid waste management planning and implementation on a regional and state level.*

While Maine's Waste-To-Energy (WTE) facilities play an important role in managing Maine's solid waste, but they were developed and have operated effectively in Maine as the result of the passage of the federal Public Utility Regulatory Policies Act (PURPA) in 1978. Based upon the provisions of PURPA, the Maine WTE's entered into Power Purchase Agreements (PPA's) with electrical utilities for the sale of electrical power they generate as a product of their operation; however, these PPA's have either recently expired or will soon expire resulting in a significant reduction in the revenue stream realized by the WTE's which has supported their operation and served to keep the tipping fees they have charged at a low level that has been competitive with the tipping fees charged for the deposit of solid waste in Maine landfills which have a much lower operating cost.

To date, Maine policy support for modern solid waste management has not included any progressive structure including effective bans, fees or other incentive mechanisms to effectively support the Maine Waste Management Hierarchy. Without State buy-in to support the Maine Waste Management Hierarchy and landfill preservation, Maine, as Elizabeth Schneider suggests, "may be becoming known as the 'dump state'." In a dump state, Mainers would pay later with perpetual monitoring and postclosure care of more and larger landfills.

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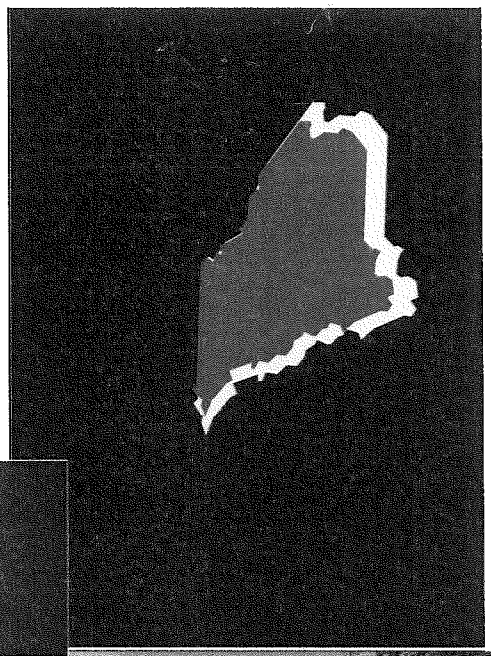
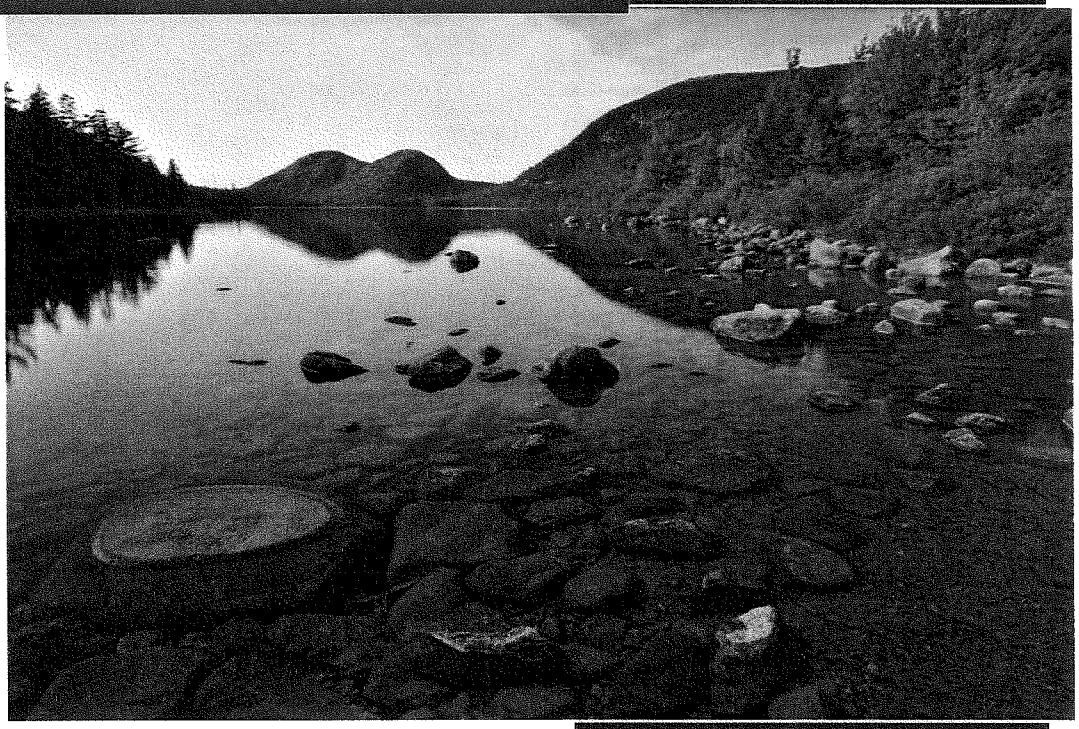
[16] http://www.mainelegislature.org/legis/statutes/38/title38sec1302.html



A Case for Waste – To – Energy In Maine



Hon. Bob Duchesne

USA Energy Group, LLC

April 2013

Executive Summary

Disposing of Maine's municipal solid waste (MSW) 40 or 50 years ago was fairly easy and straight forward. Trash was brought to a local dump where it was stacked, and eventually doused with an accelerant and burned; convenient for some, a pollution problem for the state. It was the type of open dump that ultimately encouraged both federal and state legislators to push through massive changes to environmental laws addressing clean air and water. As a result of Maine's environmental efforts it has become a national leader in preserving the environment in part by converting combustible waste into much needed renewable energy.

For over 30 years Maine has enjoyed the benefits of federal programs that support the development of an integrated waste management program to deal with the issue of MSW disposal. Some of these programs are ending, leaving Maine at a critical public policy crossroads of how to support what has been a very successful program of good public policy best described by the Municipal Review Committee's[1] mission statement:

> *The mission of the corporation is to better ensure the continuing availability to its members of long-term, reliable, safe, and environmentally sound methods of solid waste disposal at a reasonable cost.*

This report summarizes and discusses a statewide effort to preserve the current waste to energy (WTE) industry while supporting its resurgence through a practical approach to leveling the playing field for the broader WTE industry, thereby competing on an equal financial footing with other methods of MSW disposal.

Highlights

- Maine has had a leadership role in promoting good public policy and in the greening of Maine through the establishment of a waste hierarchy. Waste to energy recovery has had a strong role in that effort.
- Solid waste has been converted to beneficial use on a large scale for well over 100 years and it has matured into a safe and effective technology. It is a concept well supported, both in a business sense and by the public.
- Maine encourages recycling, which is among the most preferred waste management options aside from waste reduction. Recycling rates are higher than the national average in communities with waste to energy facilities.
- Waste to energy facilities in Maine and throughout New England, which are vital parts of New England's infrastructure, are having difficulty maintaining operations in a climate of low energy prices, increasing operating costs and ongoing state support for landfill operations.
- Maine is slowly losing waste-to-energy as an option. This is real and evidenced by the closing of MERC in December 2012.
- Government support of WTE is important to sustain price parity of municipal solid waste disposal. It has been important in the funding of waste to energy facilities that produce electricity. In 1978 the U.S. Congress passed legislation to encourage cogeneration plants which produce electric power through steam. Maine has participated in that effort, but the governmental support contracts with Maine's waste to energy facilities either have expired or will expire by 2018.
- Government support of WTE practice is consistent with Maine's other governmental financial incentives, which try to create a positive economic environment to provide support for a variety of business activities.

[1] The MRC is an organization comprised of 187 municipalities that dispose of municipal solid waste at the Penobscot Energy Recovery Company (PERC) waste to energy facility in Orrington, Maine. http://www.mrcmaine.org/

Maine should, in the same sense, provide a mechanism to give financial support to municipalities which bear the ultimate burden of waste disposal costs.

- Maine needs to develop a new legislative initiative which will allow residents and commercial sources to participate through their communities in a State managed municipal solid waste hierarchy supportive of the operational costs at a municipal and plant level.
- Maine's solid waste processing and management industry will support state policies that encourage the solid waste hierarchy through recovery of energy.
- These policy recommendations, if fully adopted, could successfully take advantage of a unique opportunity to continue the development and use of a renewable energy source at a critical time for Maine.

The legislative initiative described in the following pages really involves a matter of choice. At the state level, we need a statewide policy to manage municipal solid waste in an environmentally responsible manner. At the community level, we need to implement that policy with programs supporting all phases of the solid waste hierarchy, including waste to energy. At the most fundamental level, we need to encourage the residents of the State of Maine to embrace their obligation to plan for the future greater good by utilizing all commercially viable systems to manage solid waste needs.

Table of Contents

Introduction

Disposing of Maine's municipal solid waste (MSW) 40 or 50 years ago was fairly easy and straight forward. Trash was brought to a local dump where it was stacked and eventually doused with an accelerant and burned. While convenient for some, it was a pollution problem for the state. It was this type of open dump that ultimately encouraged both federal and state legislators to push through massive changes to environmental laws addressing clean air and water. As a result of Maine's environmental efforts, it has become a national leader in preserving the environment, in part by converting combustible waste into much needed renewable energy. In March of 2010 the EPA finalized a rule titled "Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program" that defined the biogenetic (animal or plant based) component of MSW as renewable[2] The management of MSW has matured over time as society's knowledge, technology, and overall well being has improved. These quality of life improvements also create unintended consequences in the production and consumption of food, consumer goods and other products. One consequence is the generation of significant volumes of waste material. Most of this material is ultimately discarded and requires collection, reuse, recycling or some form of managed disposal.

In 2012, many communities in Maine sent their MSW to one of the state's four[3] waste-to-energy (WTE) plants[4]. These communities, encouraged by state policy, seek to reduce the overall volume and weight of waste going to landfills by contracting with the nearest WTE facility to process household and commercial MSW. This policy makes good sense. Combustion reduces the volume of material by roughly 90% and weight by 75% that would otherwise be stored in one of the state's landfills and utilizes the heat in the generation of electricity. Over the years, these facilities have processed in excess of 16,000,000 tons of MSW, thereby keeping over twelve million tons of unprocessed waste out of Maine's landfills. The remaining tonnage of waste is non-processable which ultimately ends up in a landfill for permanent storage.

Maine, however, is at a crossroads concerning the future of the waste-to-energy industry. In addition to the higher costs associated with producing electricity from WTE facilities, when compared to large central station generation, it also is burdened with certain operational issues. These include perceived traffic congestion, noise, odor and location. Through technology, logistics and compromise, most of these issues are solvable. However, the higher cost of processing waste in a WTE facility, as compared to landfill storage, is not an operational issue that can be easily solved.

The discrepancy in the overall price of waste disposal (treatment) between landfill and WTE, creates friction between the municipalities and the WTE facilities and obscures the vital role WTE plants play in the state's economy while preserving Maine's much needed available landfill space, protecting the environment by reducing the quantity and type of waste going to landfills, and providing recycling services for certain materials that can be economically separated from the waste stream.

[2] See EPA web page "Frequent Questions about Energy Recovery from Waste" http://www.epa.gov/wastes/nonhaz/municipal/wte/faq.htm.
[3] At the end of 2012 one of the four WTE facilities ceased operation. Maine Energy Recovery Company was purchased by the city of Biddeford Maine and closed.
[4] Waste to energy facilities process household or commercial waste, use it as a fuel (through a combustion process) to create electricity.

In a recent article in the Kennebec Journal by Tux Turkel[5], he identifies what is probably the most pressing issue for the continued survival of the WTE industry in Maine:

> *"Many waste-to-energy plants were built in the 1980s and 1990s. They were able to negotiate lucrative, long-term power contracts, earning revenue that kept disposal fees down.*
>
> *Those windfalls are ending, in an era when low natural gas prices are cutting the wholesale cost of making electricity. So waste-to-energy plants are under pressure to control their tipping fees to compete with lower-cost landfills.*
>
> *..."it really is a matter of economics," said Ted Michaels, president of the Energy Recovery Council, a trade group..."It's not easy path to a resurgence, but there are opportunities"[6] Ted Michaels continued."*

This report summarizes some of these opportunities and discusses a statewide effort to preserve the current WTE industry while supporting its resurgence through a practical approach to leveling the playing field for the broader WTE industry to compete financially on an equal footing with other methods of disposal. The approach described in this white paper is an amendment to the existing state of Maine statute[7] regulating solid waste management and recycling to promote statewide cost parity for those communities who contract their waste management requirements to a qualified waste-to-energy facility. This paper will explore the economic, operational and environmental aspects of WTE technology and how it contributes to the overall business health of Maine.

[5] Portland Press Herald, April, 22, 2012, "Amid Debate, Waste-to-Energy Grows", Tux Turkel, http://www.pressherald.com/news/amid-debate-waste-to-energy-grows_2012-04-22.html

[6] Portland Press Herald, April, 22, 2012, "Amid Debate, Waste-to-Energy Grows", Tux Turkel, http://www.pressherald.com/news/amid-debate-waste-to-energy-grows_2012-04-22.html

[7] Maine Revised Statute Title 38, Chapter 24. http://www.mainelegislature.org/legis/statutes/38/title38ch24.pdf

Waste Technologies – An Overview

Maine is among 24 states (See Table 1) with Waste-to-Energy facilities and ranks 2nd[8] behind Connecticut in the percentage of trash handled by waste to energy facilities. The state currently has three operating WTE facilities located in Orrington, Portland, and Auburn. A fourth facility located in Biddeford was closed due in part to financial difficulties. This white paper and legislative effort is an attempt to prevent any of the three remaining facilities from closing.

In both 2011 and 2012 the WTE facilities processed about 830,000 tons of regional municipal solid waste (MSW) per year and, using this waste as fuel, generated over 470,000 megawatt hours of electricity per year. The economic impact of these facilities to Maine is significant. Todd Gabe Ph.D., a professor of economics at the University of Maine, estimates that the four facilities generate a state wide total annual economic impact of $137 million. Waste-to-Energy facilities in Maine directly employ 228 workers and, including indirect jobs, have a total employment impact of 597 full and part-time Maine jobs[9].

To place this into perspective and facilitate a better understanding of the solid waste disposal options available to the residents of Maine, as well as the economic impacts and alternatives, this white paper first provides an overview of the status of the various technologies, including a discussion of new projects both domestically and internationally where there is a commitment to building new facilities.

Table 1
Operating WTE Plants in the U.S.A. by State[10]

State	Number of Operating WTE Plants
Florida	11 facilities
New York	10 facilities
Minnesota	9 facilities
Massachusetts	7 facilities
Connecticut & Pennsylvania	6 facilities in each state
New Jersey & Virginia	5 facilities in each state
Maine	4 facilities[11]
California, Maryland & Michigan	3 facilities in each state
New Hampshire & Wisconsin	2 facilities in each state
Alabama, Alaska, Hawaii, Indiana, Iowa, North Carolina, Oklahoma, Oregon, Utah, & Washington	1 facility in each state
Total Number of WTE Plants	**86 facilities**

Proven Waste Technologies

Solid waste has been converted to beneficial use on a large scale for well over 100 years. In that time, the burning of MSW with energy recovery (known as WTE) has matured into a safe, effective and environmentally acceptable technology. The proven large-scale waste processing methods include incineration and starve-air

[8] "Amid Debate, Waste-to-Energy Grows", Tux Turkel, Portland Press Herald, April, 22, 2012, http://www.pressherald.com/news/amid-debate-waste-to-energy-grows_2012-04-22.html

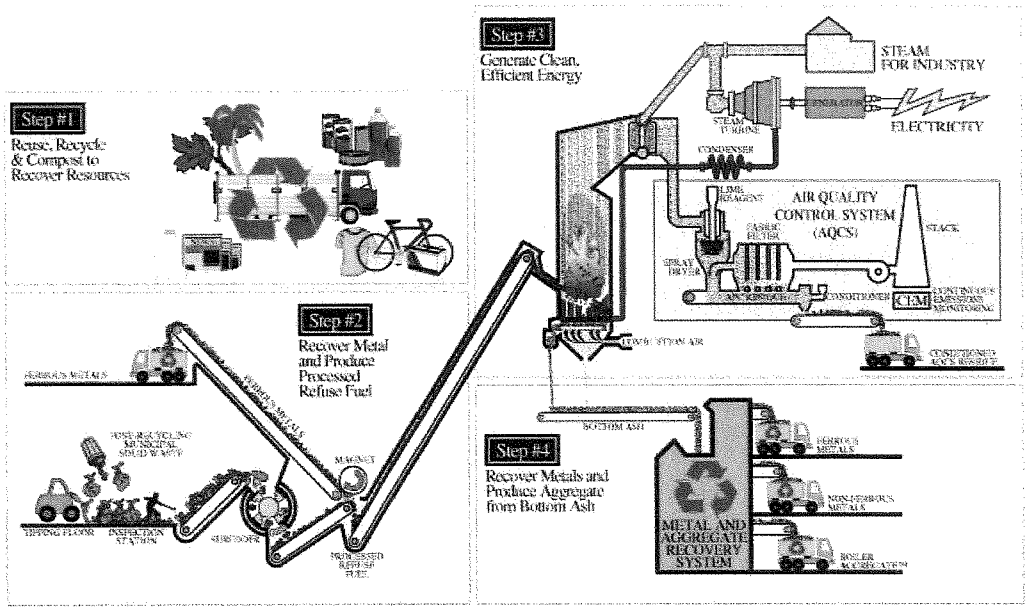
[9] See Appendix A for "Statewide Economic contribution of Maine's Waste-to-Energy Sector"; Todd Gabe Ph.D., October, 2011. The study was conducted prior to the closure of MERC.

[10] The 2010 ERC Directory of Waste to Energy Plants; http://www.energyrecoverycouncil.org/userfiles/file/ERC_2010_Directory.pdf.

[11] Maine now has 3 operational WTE facilities. Maine Energy Recovery Company was purchased by the city of Biddeford Maine and closed at the end of 2012.

combustion. The basic types of MSW combustion technologies include: mass-burn/waterwall combustion, mass-burn/starved air combustion, refuse-derived fuel (RDF)/dedicated boiler (see Figure 1 below), and RDF/fluidized bed. Other methods of MSW disposal are also being used including commercial mixed waste composting, and most often landfill storage. Maine's three remaining WTE facilities use either the mass-burn or refuse-derived fuel methods of combustion.

Figure 1
RDF Waste to Energy[12]



WTE has proven to be a reliable method for waste processing and disposal and is part of a vibrant industry of equipment manufacturers and innovators that are constantly seeking more efficient and lower emissions technologies. Modern WTE plants can be operated in parallel with aggressive recycling programs and have been proven to have an overall lower impact on the environment than landfill[13].

While new WTE facility construction has declined in the United States, the market for this equipment has increased in Europe and in Eastern Asia, with European, American and Japanese systems suppliers actively marketing their products, and consistently improving their performance. Incineration technology is well tested and is used more than any other for large scale waste processing facilities in the United States and overseas. The table below demonstrates the extent of WTE technology throughout the world.

[12] Energy Answer's website for the diagram in Figure 1 http://www.energyanswers.com/technologies/processed_refuse_fuel/index.php
[13] "Energy from Waste: Burn or Bury?"; EPA Science Matters Newsletter: http://www.epa.gov/sciencematters/april2010/scinews_energy-from-waste.htm

Table 2
Use of Waste to Energy Facilities Worldwide
(Energy Recovery Council website)[14]

Location	Number of Facilities	Amount of MSW Managed by WTE as a % of Total MSW Generated
United States	86	8 to 15% based on MSW reported by EPA and *BioCycle*
Europe	400	Varies from country to country
Japan	100	70 to 80%
Other Nations (Taiwan, Singapore, China, etc.)	70	Varies from country to country

Although most waste is generated by households (vs. commercial waste) the decision of selecting one MSW management program over another is a community wide decision. Hence the WTE industry is looking to the state to help by 1) facilitating community decisions to create a business environment that recognizes all the benefits-economic and environmental-attributable to WTE, and 2) level the playing field between the various waste management options so as to allow each community the option to choose while sharing the cost/benefit with the state.

Emerging Waste Technologies

There are many technologies currently being proposed for the treatment and disposal of MSW throughout the world. Most of these involve thermal processing; others comprise biological or chemical decomposition of the organic fraction of the waste to produce useful products like compost, feedstocks, or energy products. Technologies include pyrolysis, gasification, anaerobic digestion, mixed waste composting, plasma arc, and chemical decomposition[15].

Recent Reports/Procurements of Waste Technology

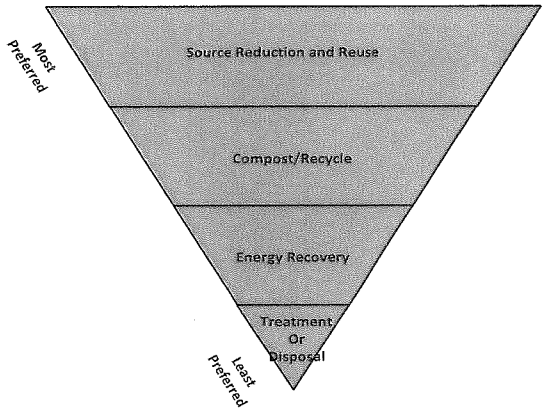
The vast majority of MSW-processing WTE facilities- constructed in the U.S. became operational prior to 1996. Only three new facilities came on-line between 1997 and 2010. In the past few years, however, interest in WTE and waste conversion has begun to grow again. This renewed interest in waste processing technologies is due to several factors: successful federal Clean Air Act (CAA) retrofits, proven WTE track record, increasing costs of fossil fuels, growing interest in renewable energy, concern over greenhouse gases, reversal of the Carbone Supreme Court Case, and the change in U.S. EPA's hierarchy, which now includes WTE[16] (see Figure 2).

[14] "Meeting the Future: Evaluating the Potential of Waste Processing Technologies to Contribute to the Solid Waste Authority's System"; Prepared for Solid Waste Authority of Palm Beach County, Florida; Prepared by Gresham, Brickner & Bratton, Inc; September 2, 2009. http://www.swa.org/pdf/SWAPBC_White_Paper_9-2-09.pdf

[15] For a complete listing and risk assessment refer to "Meeting the Future: Evaluating the Potential of Waste Processing Technologies to Contribute to the Solid Waste Authority's System"; Prepared for Solid Waste Authority of Palm Beach County, Florida; Prepared by Gresham, Brickner & Bratton, Inc; September 2, 2009. http://www.swa.org/pdf/SWAPBC_White_Paper_9-2-09.pdf

[16] http://www.epa.gov/osw/nonhaz/municipal/hierarchy.htm

Figure 2
U.S. EPA Waste Management Hierarchy



Since 2004, several municipalities commissioned reports in order to evaluate new and emerging waste management technologies and approaches. New York City, the City of Los Angeles, Los Angeles County, and King Count WA are among the municipalities that commissioned studies in waste conversion technology. In 2006, there were several procurements for WTE facilities. These include: St. Lucie County, FL; Frederick and Carroll Counties in MD; Harford County, FL; Hawaii County, HI; Pinellas County, FL; City of Tallahassee, FL; Broward County, FL; City of Sacramento, CA; Solid Waste Authority of Palm Beach County, FL; and Hillsborough and Lee Counties, FL.

In the foregoing studies, reports and procurements, a total of 78 technology vendors were represented, evaluated, screened or selected for consideration as waste processing solutions for the local entities. These 78 vendors offered 14 different technologies. The most often-cited technology was incineration, primarily mass burn and RDF[17]. In 2011, the Solid Waste Authority of Palm Beach County selected a contractor to begin construction of a new WTE facility that will process one million tons of MSW a year.[18]

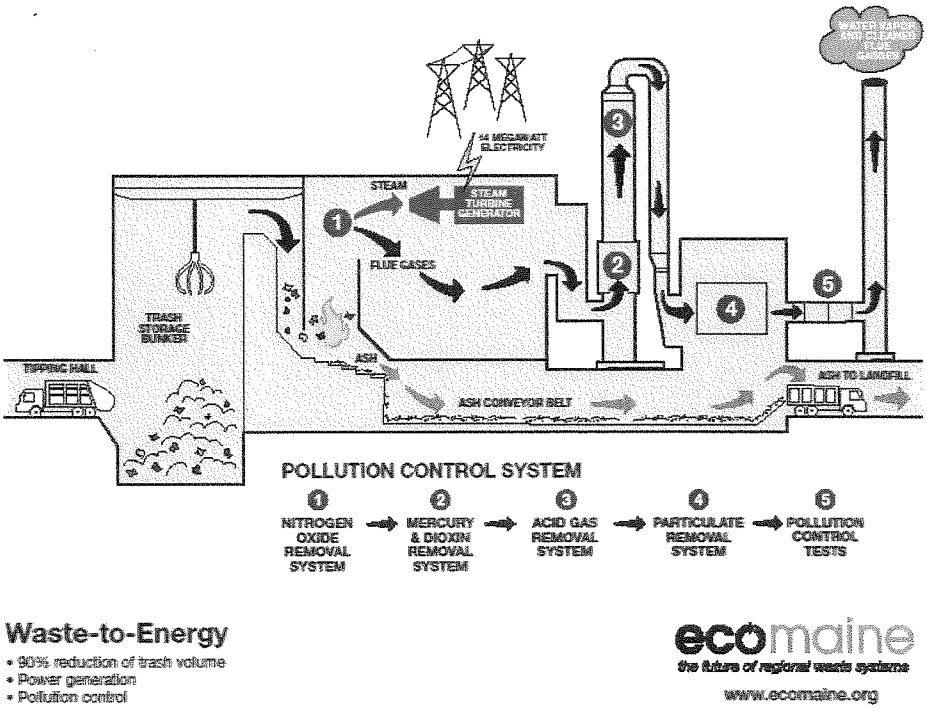
Environmental Aspects of Waste Processing Technologies

Municipal waste combustors are regulated under the federal Clean Air Act (CAA) originally passed by Congress in 1963 and amended in 1967, 1970, 1977, 1990 and 1995 and 1998. The U.S. EPA may implement and enforce the requirements or may delegate such authority to state and local regulatory agencies. The CAA places emissions limits on new municipal waste combustors. In addition, the 1995 amendments to the CAA were developed to control the emission of dioxins, mercury, hydrogen chloride and particulate matter. By modifications in the burning process and the use of activated carbon injection in the air pollution control system, dioxins and mercury, as well as hydrocarbons and other constituents, have effectively been removed from the gas stream. See Figure 3 for a diagram of ecomaine's process used to remove pollutants from a mass burn WTE facility.

[17] "Meeting the Future: Evaluating the Potential of Waste Processing Technologies to Contribute to the Solid Waste Authority's System"; Prepared for Solid Waste Authority of Palm Beach County, Florida; Prepared by Gresham, Brickner & Bratton, Inc; September 2, 2009. http://www.swa.org/pdf/SWAPBC_White_Paper_9-2-09.pdf

[18] For more information on technology selection see footnote 16. For information about the project see http://www.swa-wteproject.com/about/; and to see construction footage see http://www.swa.org/vm95webcam/ for webcam access to the construction site.

Figure 3
ecomaine's Waste to Energy Facility
Pollution Control Process[19]



The greenhouse gasses that are generated in solid waste processing and disposal that are of concern include: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (NO_2). The Waste Reduction Model (WARM), created by the U.S. EPA, helps solid waste planners and organizations estimate greenhouse gas emission reductions from several different waste management practices. WARM was applied to the national waste quantities, which indicates hundreds of thousands of metric tons of carbon being saved through WTE. The removal of CO_2 may also be convertible to carbon credits that may be sold for a source of additional revenue. Additionally, according to the EPA the "CO_2 emissions associated with combustion of plant or animal-based products...are considered to close the loop in the natural carbon cycle"[20] and that the CO_2 emissions are not counted in greenhouse gas inventories.

[19] See EcoMaine's website for more information http://www.ecomaine.org/electricgen/
[20] EPA web page "Frequent Questions about Energy Recovery from Waste" http://www.epa.gov/wastes/nonhaz/municipal/wte/faq.htm

From EPA Webpage Titled:
Frequent Questions about Energy Recovery from Waste[20]

How does energy recovery relate to renewable energy?

Our country is searching for alternative fuel sources to power our nation. Renewable energy sources such as wind, biomass, and solar can be used to supplement coal and oil to produce energy. The carbon dioxide (CO2) emissions associated with combustion of plant or animal-based products (paper and forest products, yard trimmings, food discards) are considered to close the loop in the natural carbon cycle. The CO2 emissions from combusting these materials are not counted in greenhouse gas (GHG) inventories. Conversely, CO2 emissions from materials that are made from fossil fuels (petroleum, natural gas, coal) are counted in GHG inventories, because these emissions would not enter the cycle were it not for human activity. Similarly, methane (CH4) emissions from landfills are counted in GHG inventories because, CH4 would not be emitted were it not for the human activity of landfilling the waste.

Recycling Awareness

It has been found that recycling, which is among the most preferred waste management options aside from waste reduction, is high in communities with WTE facilities (Table 3). This holds true in the United States as well as other countries. As shown in Table 3 it can be observed that most of the states with WTE have recycling rates higher than the national average of 28.6%. Apparently, where WTE exists, there is a greater public awareness of waste disposal and the need to deal with waste reduction overall. This leads to a state-wide integration of the mandated waste hierarchy into the daily life of Maine's residents.

Table 3
Recycling Rates in States with Significant WTE[21]

State	Recycling Rate	Combustion Rate
Connecticut	25%	64%
Massachusetts	37%	34%
Hawaii	25%	46%
Florida	29%	25%
Minnesota	43%	20%
Maryland	37%	20%
New York	35%	16%
Maine	**32%**	**32%**
Pennsylvania	30%	12%
New Hampshire	32%	16%
New Jersey	34%	11%
Virginia	34%	17%
Average in States with WTE	**32.7%**	**26.1%**
National Average	**28.6%**	**6.9%**

[21] "Meeting the Future: Evaluating the Potential of Waste Processing Technologies to Contribute to the Solid Waste Authority's System"; Prepared for Solid Waste Authority of Palm Beach County, Florida; Prepared by Gresham, Brickner & Bratton, Inc; September 2, 2009. http://www.swa.org/pdf/SWAPBC_White_Paper_9-2-09.pdf

Landfills – A Short and Long Term Challenge for Maine

Other methods of MSW disposal are also being used, such as large scale commercial mixed-waste composting and landfill, but they are becoming less and less attractive. Mixed-waste composting requires large land areas or high capital investment. It also can create significant odor and the compost is limited in its application. Landfill is not a processing technology; it is storage. Landfills also require large land areas, generate methane (a greenhouse gas that is more than 20 times as potent as carbon dioxide), and may create other environmental impacts such as water pollution.

Operational and Development Considerations

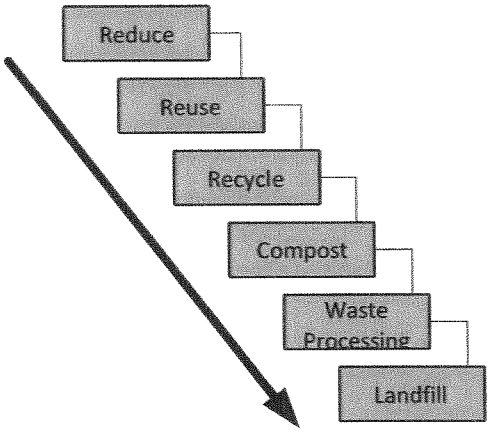
Today, many of the nation's WTE facilities are owned by local governments and private industry that have invested in this critical infrastructure to achieve long-term solid waste management solutions. These facilities produce clean energy while reducing waste volume by approximately 90 percent, making them a great option for communities seeking the most advanced technology to manage their waste and thereby extending the useful life of their designated landfill.

Waste-to-Energy Industry in Maine

The Challenge

Waste-to-energy facilities in Maine and throughout New England are vital parts of New England's infrastructure. However, they are having difficulty maintaining operations in a climate of low energy prices, increasing operating costs, and ongoing state support for landfill operations, despite Maine law that prioritizes incineration/waste-to-energy (see Figure 4). In fact, at the end of December 2012, one of Maine's WTE facilities terminated operations for some of the reasons stated above. Yet, home owners and businesses continue to generate waste and prefer a more environmentally responsible way to manage it[22]. The challenge that Maine faces is how to keep all options available while ensuring the continued and viable operation of WTE facilities.

Figure 4
Maine's Waste Management Hierarchy
(Preferred to Least Desirable)



This portion of the paper will review some of the choices and make recommendations for a strategy that sustains all of Maine's WTE facilities with little or no impact on Maine residents.

The Choices

To ensure the continued operation of vital WTE facilities, Maine legislators will be facing certain choices in upcoming Legislative sessions. These choices include:

- Enforce current state policy – Legislatively support the currently unenforced state hierarchy that delineates the order of preference for handling waste which clearly states that the WTE volume/weight reduction approach is preferable to other options such as landfilling of unprocessed MSW.
- New income sources for WTE facilities – during the last legislative session the concepts of creating a special renewable energy class for WTE and/or mandating long term energy contracts were discussed but ultimately rejected, thus shutting the door on at least two possible sources of additional income.

[22] See Appendix B for opinion poll that asked the question "Which of the following methods should Maine use to dispose of its waste in the future?" The poll clearly shows that Waste to Energy is the preferred method for future waste disposal.

- Municipal Rebate - Modify the current statues to provide communities incentives for supporting WTE by creating special criteria for towns contracting with WTE facilities so that increases in WTE tipping fees needed to sustain operations are as revenue neutral as possible to residents, homeowners, towns and Maine tax payers.
- Enhanced revenue support of some kind is needed to sustain WTE in Maine or it will face an uncertain future as one of the state's waste management options.
- Do nothing and allow WTE facilities to close as contracts expire.

The Opportunity

The following sections of this paper will make the case for a restructuring of Maine Statute Title 38, Chapter 24 that will allow the state to keep WTE facilities in operation while having as little impact as possible on Maine residents, homeowners and Maine State revenues.

The Importance of Government Support to Sustain Price Parity for Municipal Solid Waste Disposal and Clean Energy

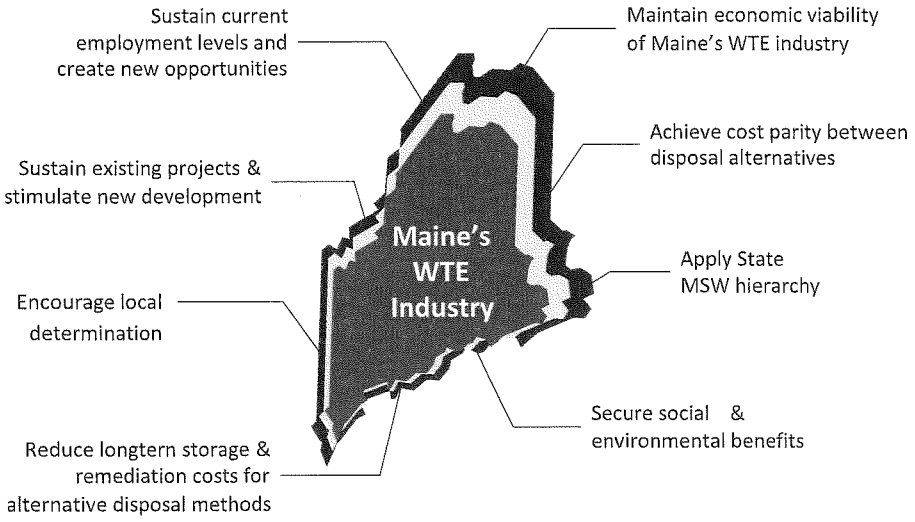
Support of Clean Technologies

One of the main arguments against government's continued support for clean energy technologies is that most subsidies to date have not worked well, and the costs of clean power generation are still higher than for traditional fossil-based electricity. Proponents of this argument also tend to believe that the clean energy industry shows no defined path forward to reducing costs, and is therefore economically inefficient to support on a go forward basis. This perspective has gained traction of late, given concerns over the mounting U.S. deficit and a political and economic need to take action to reduce government subsidies, particularly to industries that may require long-term institutional support.

Support Waste-to-Energy – A Different Approach

There is a way, however, for Maine to continue supporting WTE with as little impact as possible to state or local revenues by utilizing an existing state statue through current state methodology for sustaining the industry over the long term. The objective of this paper is to review key attributes of a targeted, minimal net cost approach to governmental support of municipal solid waste management that achieves all of the following objectives:

Figure 5
WTE is good for Maine



The balance of this paper will offer a brief summary of current federal and state incentive programs and a detailed description of the WTE statute that provides a workable approach to sustaining Maine's solid waste management industry, a vital part of the state's infrastructure.

Waste to Energy – A Need for a Private/Public Effort

WTE Implementing State Mandates

The waste to energy (WTE) industry in Maine has and continues to be a business activity that receives support from both the individual resident and the state to successfully provide recycling, waste volume reduction and environmental benefits beyond traditional disposal methods, while simultaneously generating electricity and stimulating economic growth.

As the WTE facilities reach or have reached a point in their business lifecycles where the federal mandates that facilitated their development have expired, the industry is seeking to level the playing field for all municipal solid waste (MSW) disposal options. The industry seeks this level playing field not through a top-down government restructuring, but by the bottom-up grass roots support of Maine residents who have voiced their commitment to Maine's MSW disposal hierarchy. This hierarchy mandates the following order of priority for handling MSW[23]:

1. *Reduce/ Re-use*
2. *Re-cycle/Compost*
3. *Waste Processing*
4. *Landfill*

So how might WTE and the State of Maine encourage this level playing field with minimal effect on Maine residents? Let's first review the many current financial benefits available to certain electricity generating facilities...but not necessarily WTE facilities.

Incentives Help New Industries Grow

Throughout history, government incentives have been critical in growing new industries to scale. The fossil energy industry has benefited from decades of government support, largely because successive Administrations have recognized how critical economic and reliable energy supply is to achieving national security and economic growth. The Environmental Law Institute, in a study issued in 2009, estimated that the total subsidies to the fossil fuel industry between 2002 and 2008 was $72 billion while renewables, during the same period, only received $29 billion (with almost half of the $29 billion going to corn based ethanol). Without the support, it is arguable that the domestic oil, gas and other high tech industries would ever have achieved their vast scale.

Current Federal Tax Benefits Available to Electricity Generating Facilities

State and Federal clean energy policies have made tax equity a critical component in the private-sector development and operation of clean energy projects (see Figure 6 for summary of current options). This is because tax benefits are among government's main incentives to help drive the adoption of clean energy technologies. Examples of such tax benefits on the federal level include the 30% investment tax credit (ITC - available for solar through 2016 and for wind through 2012 and scheduled for renewal; the 2.2 cent production tax credit (PTC - recently extended as part of the "fiscal cliff" legislation, for wind projects that do not elect the investment tax credit also to be renewed; and accelerated depreciation (including bonus depreciation) that can be used to offset taxable income from other sources.

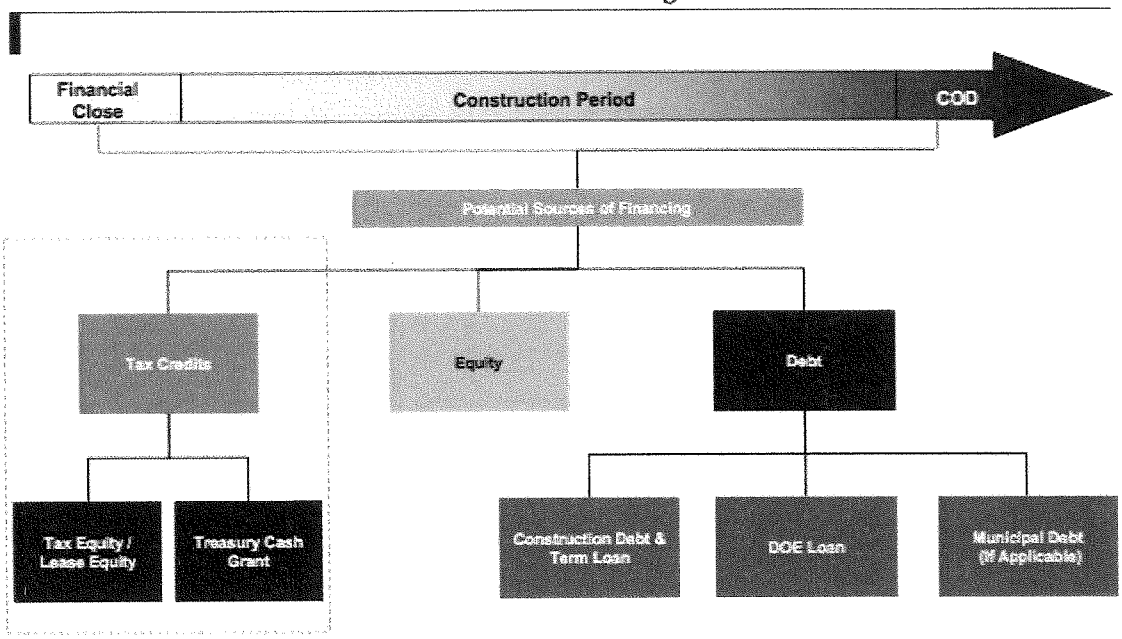
[23] Maine State Planning Office webpage regarding the Maine's waste hierarchy http://www.maine.gov/spo/recycle/hierarchy/index.htm

Over the life of the facility, the cost of energy produced by a renewable energy facility is typically higher than that produced by a conventional generating facility such as a gas fired generator; hence renewable energy projects require policy support to offset some part of the development and/or operation in order to attract investment. The predominant mechanism used to date has been tax benefits allocated to a project based on its cost to build, operate or produce energy.

Figure 6

Financing Renewable Energy Projects

Potential Sources of Financing



Source: Bank of America Merrill Lynch. This diagram describes the basic stages of a project financing as the potential sources of funding. The red-outlined box shows that the elements only available at the project's commercial operation date (COD).

Tax benefits, however can only be used by clean energy companies who are profitable enough to actually pay taxes. Because of this, many companies, whether they are start –ups that have not yet reached profitability or are established firms that earn most of their income in currently depressed energy markets, have little or no ability to use tax benefits themselves. Hence, they must find investment partners with adequate income to benefit from these and associated policies. Investment by such partners is, in fact, one of the few financing mechanisms currently available to support renewable energy projects.

Maine State Financial Incentives – Helping Residents and Businesses

Maine has granted numerous financial incentives in an effort to create an economic environment so that a variety of business activities can thrive. This provides economic benefits and jobs to the residents of Maine. For example, there are currently over 40 separately available tax credit/relief programs now operating in Maine. The cost to the state in lost revenue in 2010 was over $240 million. These current tax credits (reimbursements) benefit a wide range of services and businesses including ship building (nearly $3 million), child care (about $3.6 million), biofuels, business equipment purchases ($57 million) and multiple job programs that have simultaneously implemented state policy objectives while helping sustain or grow Maine based businesses.

Clearly there is an accepted practice in Maine for the legislature to create special financial assessments for residents and businesses if it is deemed consistent with legislative policy objectives.

The next section suggests an approach for Maine state legislators that could create a municipal incentive to directly support WTE facilities and re-formulate existing policy to effectively be revenue neutral to the State of Maine.

Waste-to-Energy Municipal Reimbursement Policy

Purpose

To develop a Maine municipal strategy that allows residents and contracted commercial sources to participate individually and collectively through their communities, in the state MSW hierarchy on an economic basis. This would sustain the environmental benefits of volume and weight reduction through Waste-to-Energy technology by means of a statewide program that supports WTE facilities.

Goal

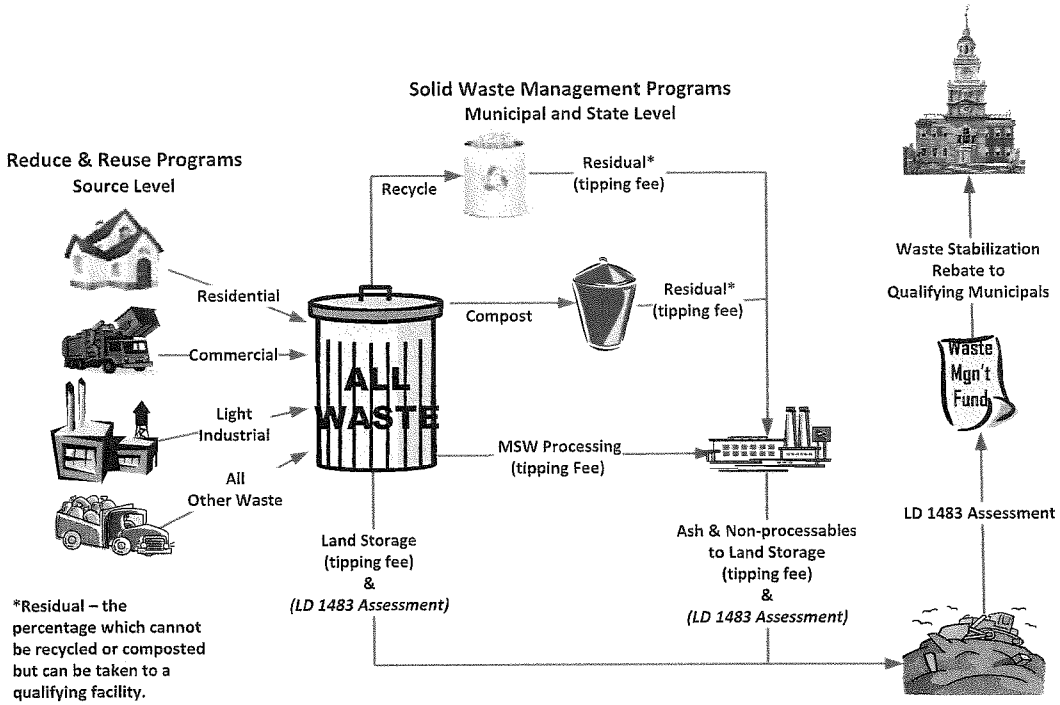
To initiate a bipartisan framework for the Maine State legislature and Governor to support the redrafting of specific sections of existing legislation that allows municipal solid waste customers located in communities that contract with qualified WTE facilities to receive a reimbursement directly to the municipality equal to the potential gap between landfill tipping fees and the projected tipping fee required to maintain the economic viability of the state's WTE industry.

How does it Work?

The basic idea is to establish a "solid waste stabilization account" by taking the existing state waste management policy and restructure provisions within the solid waste management fund to allow the fund administrator to off-set the increased cost of participating in higher value waste disposal technology, specifically Waste-to-Energy facilities. The account would be funded by assessments applied to waste deposited in landfills. When all waste tonnage that is delivered to Maine landfills are assessed appropriate costs for proper processing and disposal, it is then possible to redistribute those funds to participating municipalities thereby creating a revenue neutral position for disposing of MSW in a qualified Waste-to-Energy facility. The participating municipality would receive a reimbursement per ton of MSW delivered to a qualifying WTE facility of approximately equivalent to the difference between an audited weighted average WTE tipping fee and a similarly calculated landfill tipping fee (see Figure 7).

Since landfills are the only alternative available to the communities for waste disposal other than WTE, and landfills operate at a lower cost than do WTE facilities without providing the same social, environmental or economic benefits, they experience a distinct financial advantage. Through the use of this reimbursement policy a community can elect to support WTE without having to absorb all of the expense while receiving only a small portion of the benefits.

Figure 7
Maine's Integrated Solid Waste Management Program



Assessment Example

According to the language in LD 1483, the assessment amount for solid waste deposited in Maine landfills would be determined by the difference in average tipping fees between Maine's WTE facilities and its landfills, with this difference multiplied by the capacity of Maine's certified WTE facilities, this product divided by the total amount of waste deposited in Maine's landfills.

The economic impact study by Todd Gabe[24] estimated a difference in tipping fees between Maine's WTE faculties and its landfills ranging from $25.95 to $34.71, with a midpoint of about $30.00. Information from the Maine Department of Environmental Protection's "Waste Generation and Capacity Report for Calendar Year 2011" (revised in March of 2013)[25] shows that two existing certified[26] WTE facilities processed 248,807 tons of waste in 2011, and that the total amount of waste deposited in landfills amounted to 1,141,341 tons. The amounts of waste processed by the two facilities are used to approximate their capacities for the purpose of this example. These figures suggest that the assessment amount for all solid waste would be $6.48 per ton, which is less than the minimum amount of $10.00 per ton set in the LD 1483. This means that the assessment amount would be $10.00 per ton of waste delivered to a landfill.

[24] Economic Contribution and Fiscal Impact of Maine's Waste-to-Energy Sector; April 2013; Todd Gabe, Ph.D.

[25] For full report see http://www.maine.gov/tools/whatsnew/attach.php?id=509931&an=1

[26] At this time two of the four facilities can be certified to qualify for this reimbursement program. MERC does not qualify as it closed at year end in 2012, and PERC will not qualify due to provisions in the bill until early 2018.

Disbursement Example

According to the language in LD 1483, the disbursements provided to municipalities and recycling/composting programs would be determined by the difference in average tipping fees between Maine's WTE facilities and its landfills, with this difference multiplied by the amount of waste processed by a qualified waste processing facility.

> *Disbursement Example Applied to South Portland*
>
> ecomaine's annual report shows that South Portland brought 6,244 tons of MSW to the facility in FY 2011-2012. If the proposed Maine solid waste stabilization account were in existence at that time, South Portland would have received a disbursement of $187,320. This amount is found by multiplying the amount of MSW processed by a qualified waste processing facility, in this case ecomaine, by the $30.00 (found in the assessment example) in the average tipping fees paid to landfills and those paid to qualified waste processing facilities in Maine.

What Are the Benefits?

- The Community sees no net increase in costs over the alternative as the increased tipping fee assessed by the municipality and charged by the WTE facility is offset by state reimbursements.
- The effect on each municipality is revenue neutral as the increased tipping fee charged by WTE facility is offset through participation in the state reimbursement program.
- The State provides a growth oriented business environment for existing and future waste processing facilities, which have an important economic and fiscal impact to Maine and its residents[27].

Fiscal Impact from Continued Operations of WTE

An important issue for the State to consider when assessing the importance of the three remaining WTE facilities is the amount they contribute to state and local taxes in Maine.

To address this issue, Todd Gabe Ph.D., an economist from the University of Maine, examined the net fiscal impact of the WTE sector[28]. Net fiscal impact is defined here as the amount of taxes and government fees associated with the economic activity generated by the WTE facilities above and beyond what would be generated if the waste processed by the WTE facilities were instead stored in landfills. In other words, it is the reduction in state and local taxes and fees that would occur if the three remaining WTE facilities were to close. The fiscal impacts are related to the economic output (i.e., $101 million in revenue, including multiplier effects), employment (404 full- and part-time jobs, including multiplier effects) and income ($23.4 million in labor income, including multiplier effects) supported by the WTE sector.

Although the estimated future net fiscal impacts vary over time due to a variety of factors explained in the report, they indicate that Maine and its municipalities would lose an average of $12.6 million per year in state and local taxes and government fees if the WTE facilities were to close.

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[27] See Appendix A for "Statewide Economic contribution of Maine's Waste-to-Energy Sector"; Todd Gabe Ph.D., October, 2011. The study was conducted prior to the closure of MERC.

[28] See Appendix A for "Statewide Economic contribution of Maine's Waste-to-Energy Sector"; Todd Gabe Ph.D., October, 2011. The study was conducted prior to the closure of MERC.

The report states:

> "If Maine's three remaining WTE facilities were to close and the wastes they process were instead stored in landfills, the state and its municipalities would lose an estimated $12.6 million in taxes and fees per year, on average, between 2011 and 2029."[29]

Other Advantages of this Approach

- It does NOT impact electric rates.
- It is a statewide program that impacts those who take waste to a landfill.
- Municipal reimbursements are a common state based incentive approach.
- Municipal cost reduction is a strong plus for government.
- The state does not pick winners and losers; rather, residents through their town council elect to participate.
- It facilitates municipal- by- municipal civic participation in the state waste management hierarchy
- Public/Private ownership provides full financial transparency.
- Municipalities continue to receive economic benefit through participation in the solid waste hierarchy.
- It encourages the continued use of the existing WTE infrastructure for volume reduction.
- Private haulers are protected from additional costs as all solid waste tonnage in state are included in the program.
- The state reinforces its hierarchy.
- It supports WTE with its lower environmental impact compared to landfilling.

[29] See Appendix A for "Statewide Economic contribution of Maine's Waste-to-Energy Sector"; Todd Gabe Ph.D., October, 2011. The study was conducted prior to the closure of MERC.

Recap

Waste to Energy facilities are a vital part of the infrastructure of the State of Maine and need to be maintained in operation. Currently, and likely in the future, lower energy prices and increased operating costs create a bleak outlook for the continued viable operation of the WTE facilities in Maine. In fact, as of this writing, the MERC facility has closed down due to financial and community difficulties. Hence, it is suggested that the legislators consider revising legislation that offer a cost sharing structure that insulates municipalities from the needed increase in tipping fees while preserving a critical part of Maine's industrial complex.

Table 4
Features and Benefits of LR 1172

Feature	Benefit
Economic Activity	• Employment • Business opportunities • State and local taxes • Capital investment • Rewards municipal participation
Environmental Responsibility	• Full compliance with regulations • Reduction of waste in volume and weight • Extends life of landfills • Supports and encourages reduce, reuse and recycle • Optimum utilization of existing waste infrastructure
Ease of Administration	• Utilizes existing state statues • Reporting requirements currently in place • Provides for added departmental staff • Processing of disbursement occurs only once a year • Municipalities apply directly

Conclusions & Recommendations

We will always Have MSW

Municipal solid waste is an unavoidable by-product of human activities. Even with the most successful of recycling efforts, there will always be a need to dispose of waste. Consequently, solid waste management is a serious issue in Maine as well as the rest of the country, in particular since we consume an estimated 20 – 25% of the world's energy and materials while generating twice as much MSW per capita as developed nations in the European Union and Japan. Therefore, there exists a great need for waste reduction and recycling of materials. However, experience has shown that after these efforts to reduce, reuse and recycle there remains a large fraction of MSW requiring further processing and disposal.

Two Primary Approaches to Disposing of MSW

The two available means for disposal are burying MSW in landfills (storage) or combusting it in specifically designed chambers at high temperatures, thereby reducing it to one tenth of its original volume while converting it to ash, a combustion by-product. The heat generated by combustion is transferred to steam that can flow through a turbine to generate electricity, aka the waste-to-energy process. WTE converts the energy from combustion of MSW to electricity and recovers and recycles many of the metals contained in the MSW while the remaining ash is either used in landfills for daily cover and landfill roads or cleaned up and used off site for other construction purposes (as is done in the EU and Japan).

New WTE Facilities are Being Built Outside of the US

In contrast to what is happening in the US, from 1995-2006, hundreds of new WTE facilities were built in the European Union, Japan, Russia, China, and over thirty other nations where landfilling is regarded as environmentally undesirable and a waste of energy and land use. In fact, in the years 2000-2007, the global WTE capacity grew at the rate of about four million tons each year. The growth of WTE in the EU is partly due to a directive of the European Community that mandates that wastes containing over 2% combustible material shall not be landfilled in order to reduce landfill emissions of methane, the second most important greenhouse gas, and preserve land for future generations.

WTE is Environmentally more attractive than Alternatives

As previously stated, WTE is a proven, environmentally friendly process that provides reliable electricity generation and sustainable disposal of post-recycling MSW. WTE technology is used extensively in Europe and other developed nations in Asia such as Russia, Japan Singapore and Taiwan. Additionally, new policies to encourage WTE can have a sizeable effect on reducing greenhouse gas emissions.[30] In fact, nation-wide use of the WTE technology can become one of the big contributors to America's planned reduction in greenhouse gas emissions.

Maine and the US Need New Policies to Support Sound Waste Management

New policies to encourage WTE can also have a meaningful impact in reducing our dependence on fossil fuels and increasing production of renewable energy. The nation currently landfills about 248 million tons of waste per year so there is a significant potential to increase energy production from WTE. Every three tons of MSW processed in a WTE facility avoids the need to mine one ton of coal or the importation of three barrels of oil. If

[30] Waste-to-Energy: A Renewable Energy Source from Municipal Solid Waste: Executive Summary, ASME; http://files.asme.org/Divisions/MER/17157.pdf

all waste were processed in qualified WTE facilities, it could satisfy 3 to 4% of the country's electricity demand. Additional environmental benefits of an active WTE industry include:

- Minimal high voltage transmission requirements
- Complements recycling and reduces landfilling
- Reduces truck traffic and associated emissions
- Recovers and recycles metals thus reducing mining operations

WTE Technology is Constantly Improving – Innovation Abounds

WTE technology has significantly advanced with the implementation of the Clean Air Act, dramatically reducing all emissions. The EPA concluded that WTE now produces electricity with less environmental impact than almost any other source[31]. WTE also operates 24/7 to reduce base load fossil fuel generation and is desirably located in proximity to urban areas where the power is most needed.

It is also notable that WTE was designated as renewable in the 2005 Energy Policy Act, by the US Department of Energy and by twenty-three state governments. Excluding hydroelectric power, only 2% of the US electricity is generated from renewable energy sources. A third of this renewable energy is due to WTE which at this time processes about 8% of US MSW.

Maine Needs to Act Now Before Another WTE Facility Closes

In light of its many beneficial characteristics, Maine's solid waste processing and management industry supports state policies that encourage the solid waste hierarchy through recovery of energy from controlled combustion of MSW. The Waste to Energy industry encourages the State of Maine to consider enacting legislation that would provide a revenue reimbursement program to Participating Municipalities for utilizing WTE facilities in the management of their MSW. In so doing, communities will realize a level playing field for all forms of waste disposal and will enable residents of the state to select waste management options consistent with their environmental and economic positions. Additionally, the state of Maine would realize many benefits:

a) All economic activity ($137 million)
b) All direct employees (228)
c) A portion of the indirect jobs (597)
d) stimulus for technology growth
e) Sustain efficient waste volume reduction technology
f) Support State's solid waste hierarchy
g) Preserve longterm landfill capacity
h) Sustain environmental benefits of WTE vs. landfills

These policy recommendations, if fully adopted, could successfully take advantage of a unique opportunity to continue the development and use of a renewable, clean energy source at a critical time for our state. The residents will also be well served by recovery of reusable materials, reduced truck traffic and highway congestion, less dependence on landfill for solid waste disposal and less dependence on foreign sources of energy.

[31] Letter from EPA Administration to Integrated Waste Services Association, Feb. 14, 2003; http://energyrecoverycouncil.org/userfiles/file/epaletter.pdf

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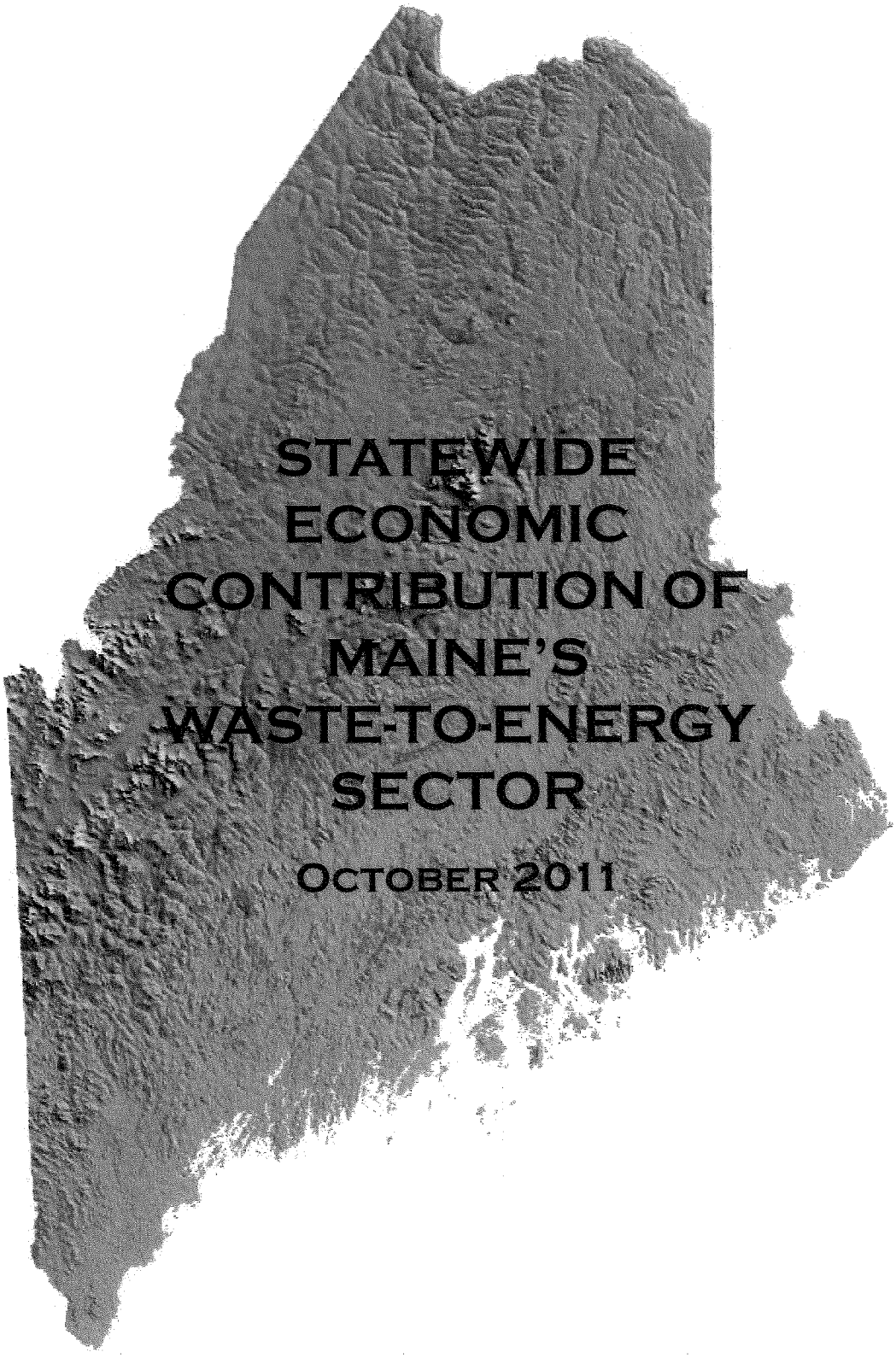
Appendix A

Statewide Economic contribution of
Maine's Waste-to-Energy Sector

Todd Gabe Ph.D.

October, 2011.



STATE WIDE ECONOMIC CONTRIBUTION OF MAINE'S WASTE-TO-ENERGY SECTOR

October 2011

STATEWIDE ECONOMIC CONTRIBUTION OF MAINE'S WASTE-TO-ENERGY SECTOR

October 2011

Todd Gabe, Ph.D.

For the Maine Waste-to-Energy Working Group, including:

ecomaine, Portland
Maine Energy Recovery Company, Biddeford
Mid-Maine Waste Action Corporation, Auburn
Penobscot Energy Recovery Company, Orrington

Summary of Economic Impact Results

Total statewide annual economic contribution - $137.0 million

→ Direct jobs impact – 228 workers in the four waste-to-energy facilities

→ Direct labor income impact - $19.5 million in wages, salaries and benefits paid by the facilities ($85,691 per worker)

→ Jobs multiplier effects – 369 full- and part-time Maine jobs outside the waste-to-energy sector

→ Labor income multiplier effects - $14.3 million in wages, salaries and benefits received by Maine workers outside the waste-to-energy sector

→ Total jobs impact – 597 full- and part-time jobs located across Maine. Waste-to-energy employment multiplier (ratio of total jobs to direct jobs) of 2.62 is among the highest of all Maine industries.

→ Total labor income impact - $33.9 million in wages, salaries and benefits received by Maine workers ($56,713 per worker)

INTRODUCTION

There are four waste-to-energy facilities located in Maine: ecomaine in Portland, Maine Energy Recovery Company (MERC) in Biddeford, Mid-Maine Waste Action Corporation (MMWAC) in Auburn, and Penobscot Energy Recovery Company (PERC) in Orrington. These facilities collectively process 830,000 tons of waste per year and produce an estimated 474,700 MWhs/yr of electricity.[1] Maine is one of 24 states with a waste-to-energy sector and, as of 2010, Maine ranked 9th nationally (of these 24 states) in terms of the number of waste-to-energy facilities, and 11th nationally in terms of "trash capacity" per day.[2]

The purpose of this study is to examine the economic contribution of Maine's waste-to-energy facilities. Economic contribution is defined as the revenue, employment and labor income (e.g., wages, salaries and benefits) that are directly associated with the four facilities, as well as the multiplier effects supported by the purchases of businesses (i.e., indirect impacts) and workers (i.e., induced impacts) related to the waste-to-energy industry. The results presented in this report are based on information provided by the waste-to-energy facilities on their annual operations for the most recent year available. An economic impact (IMPLAN) model of the overall Maine economy –and counties where the facilities are located –is used to estimate multiplier effects.

Table 1 provides an economic overview of Maine's waste-to-energy sector. It is made up of four facilities, located across the state, which generate a total of $93.4 million in annual revenue. The facilities range in annual revenue from a low of $6.3 million (MMWAC) to a high of $40 million (PERC). Maine's waste-to-energy sector directly supports 228 jobs, which provide $19.5 million in labor income (e.g., wages, salaries and benefits), an average of $85,691 per worker. The relatively high average wages and salaries paid to workers directly employed by Maine's waste-to-energy facilities are a reflection of high productivity and the specialized technical and/or business skills required to work in the industry. Some of the occupations more

Table 1. Overview of Maine's Waste-to-Energy Sector

Facility	Location	Revenue	Employment	Labor Income
ecomaine	Portland	$23,563,700	46	$4,179,800
Maine Energy Recovery Company (MERC)	Biddeford	$23,506,562	79	$6,409,669
Mid-Maine Waste Action Corporation (MMWAC)	Auburn	$6,313,849	28	$2,448,023
Penobscot Energy Recovery Company (PERC)	Orrington	$40,000,000	75	$6,500,000
	Total	$93,384,111	228	$19,537,492

Notes: Revenue, employment and payroll figures were provided (for the most recent year available) by ecomaine, MERC, MMWAC and PERC. Employment figures include full- and part-time positions. Labor income figures include wages, salaries and benefits.

1 These figures are from an April 2011 report, titled "Waste to Energy Power," by the State of Maine Governor's Office of Energy Independence and Security.

2 These figures are from a U.S. Energy Recovery Council report, titled "The 2010 ERC Directory of Waste-to-Energy Plants."

commonly employed by the waste-to-energy facilities include power plant operators, electrical engineers, industrial machinery mechanics, computer systems analysts, welders, electricians, attorneys, accountants, refractory workers, masons, and heavy equipment operators.[3]

STATEWIDE ECONOMIC IMPACT ANALYSIS

Table 2 presents results on the statewide economic contribution of Maine's waste-to-energy sector. The industry's "direct impact" is the annual revenue, employment, and labor income associated with the four facilities, as shown in Table 1.

Table 2. Statewide Economic Contribution of Maine's Waste-to-Energy Sector

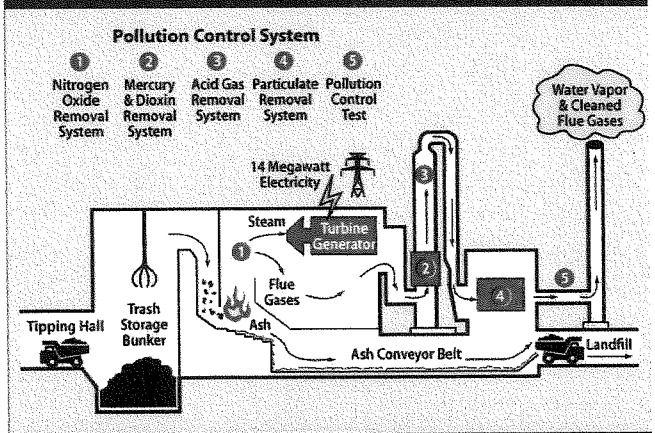
	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Revenue	$93,384,111	$20,606,027	$23,042,375	$137,032,513
Employment	228	160	209	597
Labor Income	$19,537,492	$6,483,911	$7,836,364	$33,857,767

Notes: Direct revenue, employment and labor income figures were provided (for the most recent year available) by ecomaine, MERC, MMWAC and PERC. Multiplier effects were estimated using an economic impact (IMPLAN) model of the Maine economy.

The indirect and induced impacts, collectively referred to as the "multiplier effects," are the additional revenue, employment, and labor income in Maine that are supported by the purchases of businesses (i.e., indirect) and workers (i.e., induced) related to the waste-to-energy industry.

The IMPLAN model, used to estimate the multiplier effects, is an input-output framework that traces the flows of expenditures and income through the Maine economy with a complex system of accounts that are uniquely tailored to the region.[4] Underlying these accounts is information regarding transactions occurring among industries located in Maine, the spending patterns of households, and transactions occurring between the state and the rest of the world. Some of the data sources used to develop the IMPLAN model include County Business Patterns of the U.S. Census Bureau, Regional Economic Information System (REIS) data, and input-output accounts from the U.S. Bureau of Economic Analysis, and ES-202 statistics from the U.S. Bureau of Labor Statistics.

Waste to Energy Plant Diagram



Source: ecomaine.

Including multiplier effects, the Maine waste-to-energy industry has an annual statewide economic contribution of an estimated $137.0 million in revenue, 597 full- and part-time jobs, and $33.9 million in labor income.[5] These figures indicate that

3 This list of occupations was assembled using information from the National Industry-Occupational Employment Matrix developed by the U.S. Bureau of Labor Statistics and job titles provided by the Maine Waste-to-Energy Working Group.

4 Version 3.0 of the IMPLAN model has information on 440 sectors of the economy. The waste-to-energy industry is classified in the economic impact analysis as a "hybrid" of the IMPLAN sectors "Electric Power Generation, Transmission and Distribution" and "Waste Management and Remediation Services." The exact weights applied to these IMPLAN sectors are determined using the direct revenue, employment and labor income figures provided by each of the waste-to-energy facilities.

5 The employment figures in the IMPLAN model are based on a headcount and do not differentiate between full and part-time workers. The labor income figures in IMPLAN include wages and salaries, as well as employer-paid benefits.

the workers directly and indirectly impacted by the waste-to-energy sector earn an average of $56,713 in labor income per year. As noted above, the individuals directly employed by the waste-to-energy facilities earn an average of $85,691 per worker, an amount that reflects the high productivity and technical nature of the industry's labor demands. The workers employed outside of the four facilities (i.e., supported by the purchases of businesses and workers related to the waste-to-energy sector) earn an average of $38,808 in labor income per year.[6] As shown below, the jobs outside of the waste-to-energy sector cut across the entire Maine economy, which includes a mix of high-skilled and low-skilled occupations.

Table 3. Maine Statewide Employment Multipliers by 2-Digit NAICS Category

NAICS Category	Industry Description	Employment Multiplier
22 & 56	Waste-to-Energy Sector	2.62
11	Agriculture, Forestry, Fishing and Hunting	1.44
21	Mining, Quarrying, and Oil and Gas Extraction	1.80
22	Utilities	2.61
23	Construction	1.64
31-33	Manufacturing	2.66
42	Wholesale Trade	1.96
44-45	Retail Trade	1.29
48-49	Transportation and Warehousing	1.74
51	Information	2.22
52	Finance and Insurance	2.35
53	Real Estate and Rental and Leasing	1.82
54	Professional, Scientific, and Technical Services	1.69
55	Management of Companies and Enterprises	2.22
56	Administrative and Support and Waste Management and Remediation Services	1.44
61	Educational Services	1.42
62	Health Care and Social Assistance	1.66
71	Arts, Entertainment, and Recreation	1.37
72	Accommodation and Food Services	1.37
81	Other Services (except Public Administration)	1.39

Source: Maine IMPLAN model.

Note: The waste-to-energy sector is a "hybrid" of the Utilities, and Administrative and Support and Waste Management and Remediation Services major industrial categories.

The revenue multiplier of 1.47, defined as the ratio of total revenue ($137.0 million) to direct revenue ($93.4 million), suggests that every $1.00 of sales revenue in the industry supports a total of $1.47 in statewide economic activity; that is, the "initial" $1.00 in revenue plus an additional $0.47. The employment multiplier of 2.62, calculated as the ratio of total (597 jobs) to direct (228 jobs) employment, suggests that the economic activity associated with each person directly employed in the waste-to-energy industry supports a total of 2.62 Maine jobs; that is, the person in one of the state's four waste-to-energy facilities and an additional 1.62 full- or part-time jobs elsewhere in the state.[7]

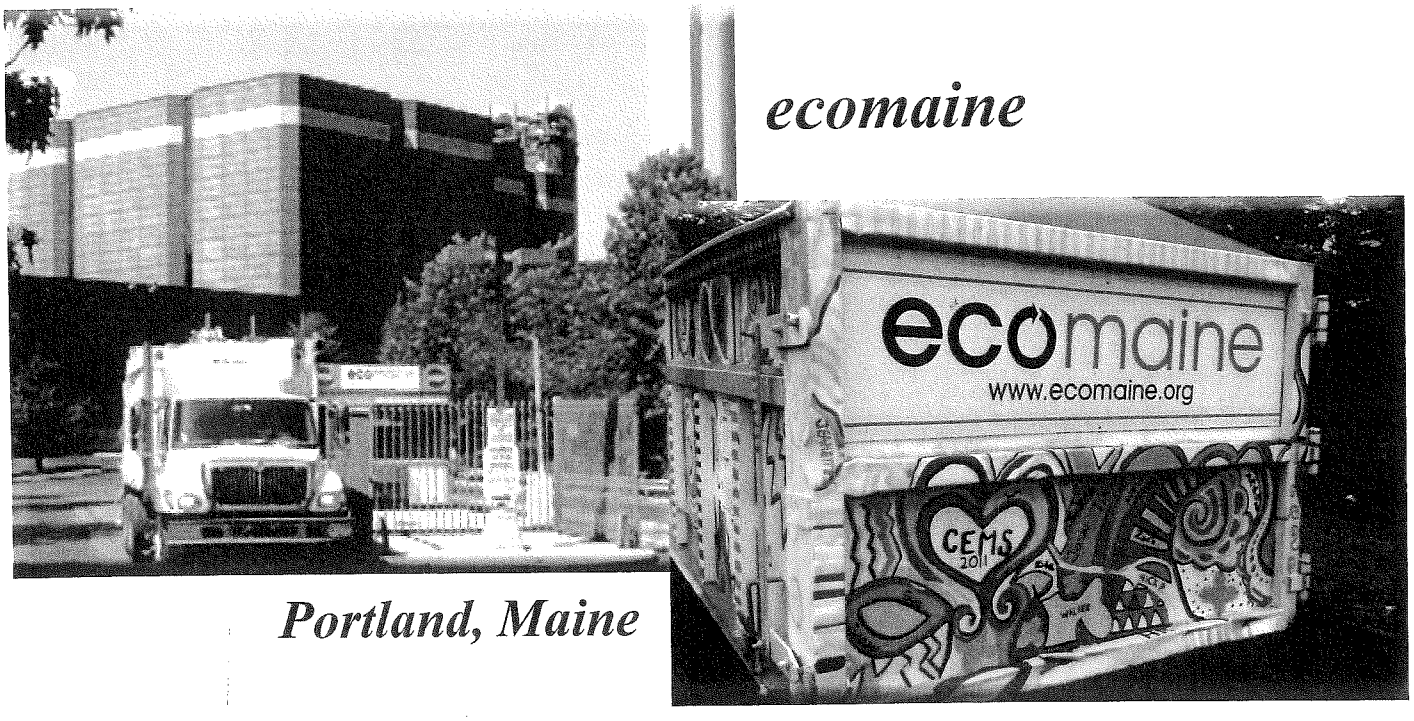
To put these figures into perspective, Table 3 shows a list of statewide employment multipliers by major (i.e., 2 digit NAICS) industrial category. The size of an industry's employment multiplier depends on – among other factors – the amount of revenue generated per worker (i.e., high productivity increases the employment multiplier), the extent to which the industry purchases goods and services produced in Maine (i.e., more in-state purchases increases the employment multiplier), and the full- versus part-time nature of employment in the

6 This average labor income figure of $38,808 is estimated by the Maine IMPLAN model. The average labor income of workers inside the waste-to-energy facilities ($85,691) and outside of the facilities ($38,808) are used to estimate the average labor income of workers directly and indirectly impacted by the waste-to-energy sector ($56,713).

7 A 2009 study ("The Existing and Potential Economic Impact of the Energy-from-Waste Industry in Florida") by Thomas Conoscenti found that every direct job in the Florida waste-to-energy sector would support an additional 1.30 jobs elsewhere in the state. This employment multiplier of 2.30 for Florida is similar to, but slightly lower than, the statewide employment multiplier of 2.62 estimated for the Maine waste-to-energy sector.

industry (i.e., sectors with more part-time workers have lower employment multipliers). In the case of Maine's waste-to-energy sector, the relatively large employment multiplier of 2.62 is explained, in part, by the high productivity of workers directly employed by the facilities (average revenue of $409,579 per worker). Although employment multipliers vary across individual sectors within the major industrial categories, the waste-to-energy sector has an employment multiplier that is similar to those estimated for the broadly-defined Manufacturing (also characterized by high amounts of revenue per worker) and Utilities sectors. The employment multiplier estimated for the waste-to-energy sector is larger than the multipliers for Retail and Wholesale Trade, and several of the service-related major industrial categories (e.g., Educational Services, Healthcare and Social Assistance, Administrative and Support and Waste Management and Remediation Services). Worker productivity is considerably lower in these broad industries of the Maine economy as compared to the average amount of revenue generated per worker in the waste-to-energy facilities.

In Tables 4, 5 and 6, we show revenue, employment, and labor income impact results by major industrial category. As indicated in footnote 4, the waste-to-energy facilities are classified in the economic impact model as a "hybrid" of IMPLAN sectors "Electric Power Generation, Transmission and Distribution" (part of the "Utilities" 2-digit NAICS category) and "Waste Management and Remediation Services" (part of the "Administrative and Support and Waste Management and Remediation" 2-digit NAICS category). Based on the revenue figures shown in Table 4, the sectors that are most heavily impacted by the spending of businesses and workers related to the waste-to-energy facilities include Finance and Insurance; Healthcare and Social Assistance; and Professional, Scientific, and Technical Services. Sectors with indirect impacts that substantially exceed the induced impacts (e.g., Transportation and Warehousing; Construction; and Professional, Scientific, and Technical Services) are those industries more apt to sell goods and services to businesses related to the waste-to-energy facilities, as opposed to their workers. On the other hand, sectors that primarily sell goods and services to individuals (e.g., Educational Services; Healthcare and Social Assistance; and Retail Trade) are characterized by induced impacts that exceed the indirect impacts.



Portland, Maine

Table 4. Statewide Economic Contribution of Maine's Waste-to-Energy Sector: Revenue Impacts by 2-digit NAICS Category

NAICS Category	Industry Description	Direct Impact	Indirect Impact	Induced Impact	Total Impact
22 & 56	Waste-to-Energy Sector	$93,384,111	*	*	$93,384,111
11	Agriculture, Forestry, Fishing and Hunting	$0	$32,427	$98,618	$131,045
21	Mining, Quarrying, and Oil and Gas Extraction	$0	$233,068	$12,648	$245,716
22	Utilities	**	$113,358	$304,288	$417,646
23	Construction	$0	$1,958,520	$208,081	$2,166,601
31-33	Manufacturing	$0	$1,875,868	$1,092,974	$2,968,842
42	Wholesale Trade	$0	$596,444	$835,713	$1,432,157
44-45	Retail Trade	$0	$114,236	$2,327,477	$2,441,713
48-49	Transportation and Warehousing	$0	$3,510,279	$549,578	$4,059,857
51	Information	$0	$1,285,251	$651,765	$1,937,016
52	Finance and Insurance	$0	$2,466,331	$3,108,796	$5,575,127
53	Real Estate and Rental and Leasing	$0	$951,063	$1,235,356	$2,186,419
54	Professional, Scientific, and Technical Services	$0	$2,840,985	$804,088	$3,645,073
55	Management of Companies and Enterprises	$0	$299,372	$178,605	$477,977
56	Administrative & Support and Waste Management & Remediation Services	**	$2,077,252	$514,375	$2,591,627
61	Educational Services	$0	$10,717	$433,906	$444,623
62	Health Care and Social Assistance	$0	$177	$4,586,794	$4,586,971
71	Arts, Entertainment, and Recreation	$0	$176,436	$381,043	$557,479
72	Accommodation and Food Services	$0	$1,395,234	$1,341,805	$2,737,039
81	Other Services (except Public Administration)	$0	$362,679	$1,012,089	$1,374,768
n.a.	n.a.	$0	$306,329	$3,364,374	$3,670,703
	Total:	$93,384,111	$20,606,027	$23,042,375	$137,032,513

Notes: Direct revenue figures were provided (for the most recent year available) by ecomaine, MERC, MMWAC and PERC. Multiplier effects were estimated using an economic impact (IMPLAN) model of the Maine economy.

* The indirect and induced impacts related to the waste-to-energy facilities are captured in the multiplier effects associated with the Utilities, and Administrative and Support and Waste Management and Remediation Services industries.

** The direct impacts related to the waste-to-energy facilities, which are classified in the study as a "hybrid" of the Utilities, and Administrative and Support and Waste Management and Remediation Services major industrial categories, are shown in the first row of figures.

Table 5. Statewide Economic Contribution of Maine's Waste-to-Energy Sector: Employment Impacts by 2-digit NAICS Category

NAICS Category	Industry Description	Direct Impact	Indirect Impact	Induced Impact	Total Impact
22 & 56	Waste-to-Energy Sector	228	*	*	228
11	Agriculture, Forestry, Fishing and Hunting	0.0	0.4	1.4	1.8
21	Mining, Quarrying, and Oil and Gas Extraction	0.0	1.0	0.0	1.0
22	Utilities	**	0.2	0.5	0.7
23	Construction	0.0	22.2	2.2	24.4
31-33	Manufacturing	0.0	1.4	1.2	2.6
42	Wholesale Trade	0.0	3.8	5.4	9.3
44-45	Retail Trade	0.0	2.0	41.9	44.0
48-49	Transportation and Warehousing	0.0	17.9	4.9	22.8
51	Information	0.0	7.3	3.0	10.3
52	Finance and Insurance	0.0	10.8	13.2	24.0
53	Real Estate and Rental and Leasing	0.0	7.3	12.2	19.5
54	Professional, Scientific, and Technical Services	0.0	25.6	8.0	33.6
55	Management of Companies and Enterprises	0.0	1.7	1.0	2.7
56	Administrative & Support and Waste Management & Remediation Services	**	23.8	7.9	31.7
61	Educational Services	0.0	0.1	7.2	7.3
62	Health Care and Social Assistance	0.0	0.0	46.3	46.3
71	Arts, Entertainment, and Recreation	0.0	4.5	7.8	12.3
72	Accommodation and Food Services	0.0	23.8	22.9	46.7
81	Other Services (except Public Administration)	0.0	4.8	20.1	24.9
n.a.	n.a	0.0	1.3	1.9	3.2
	Total:	228	160	209	597

Notes: Direct employment figures were provided (for the most recent year available) by ecomaine, MERC, MMWAC and PERC. Multiplier effects were estimated using an economic impact (IMPLAN) model of the Maine economy.

* The indirect and induced impacts related to the waste-to-energy facilities are captured in the multiplier effects associated with the Utilities, and Administrative and Support and Waste Management and Remediation Services industries.

** The direct impacts related to the waste-to-energy facilities, which are classified in the study as a "hybrid" of the Utilities, and Administrative and Support and Waste Management and Remediation Services major industrial categories, are shown in the first row of figures.

Table 6. Statewide Economic Contribution of Maine's Waste-to-Energy Sector: Labor Income Impacts by 2-digit NAICS Category

NAICS Category	Industry Description	Direct Impact	Indirect Impact	Induced Impact	Total Impact
22 & 56	Waste-to-Energy Sector	$19,537,492	*	*	$19,537,492
11	Agriculture, Forestry, Fishing and Hunting	$0	$9,402	$33,816	$43,218
21	Mining, Quarrying, and Oil and Gas Extraction	$0	$31,426	$1,760	$33,186
22	Utilities	**	$23,127	$61,960	$85,087
23	Construction	$0	$732,612	$77,317	$809,929
31-33	Manufacturing	$0	$129,200	$121,928	$251,128
42	Wholesale Trade	$0	$243,186	$340,742	$583,928
44-45	Retail Trade	$0	$63,035	$1,236,796	$1,299,832
48-49	Transportation and Warehousing	$0	$1,152,026	$240,600	$1,392,627
51	Information	$0	$356,110	$160,862	$516,973
52	Finance and Insurance	$0	$627,278	$815,136	$1,442,414
53	Real Estate and Rental and Leasing	$0	$137,235	$151,213	$288,448
54	Professional, Scientific, and Technical Services	$0	$1,226,028	$380,499	$1,606,527
55	Management of Companies and Enterprises	$0	$138,470	$82,611	$221,081
56	Administrative & Support and Waste Management & Remediation Services	**	$763,029	$227,792	$990,821
61	Educational Services	$0	$5,131	$225,147	$230,278
62	Health Care and Social Assistance	$0	$70	$2,374,521	$2,374,591
71	Arts, Entertainment, and Recreation	$0	$80,417	$151,958	$232,375
72	Accommodation and Food Services	$0	$504,105	$484,218	$988,323
81	Other Services (except Public Administration)	$0	$182,738	$541,636	$724,374
n.a.	n.a.	$0	$79,285	$125,850	$205,135
	Total:	$19,537,492	$6,483,911	$7,836,364	$33,857,767

Notes: Direct employment figures were provided (for the most recent year available) by ecomaine, MERC, MMWAC and PERC. Multiplier effects were estimated using an economic impact (IMPLAN) model of the Maine economy.

* The indirect and induced impacts related to the waste-to-energy facilities are captured in the multiplier effects associated with the Utilities, and Administrative and Support and Waste Management and Remediation Services industries.

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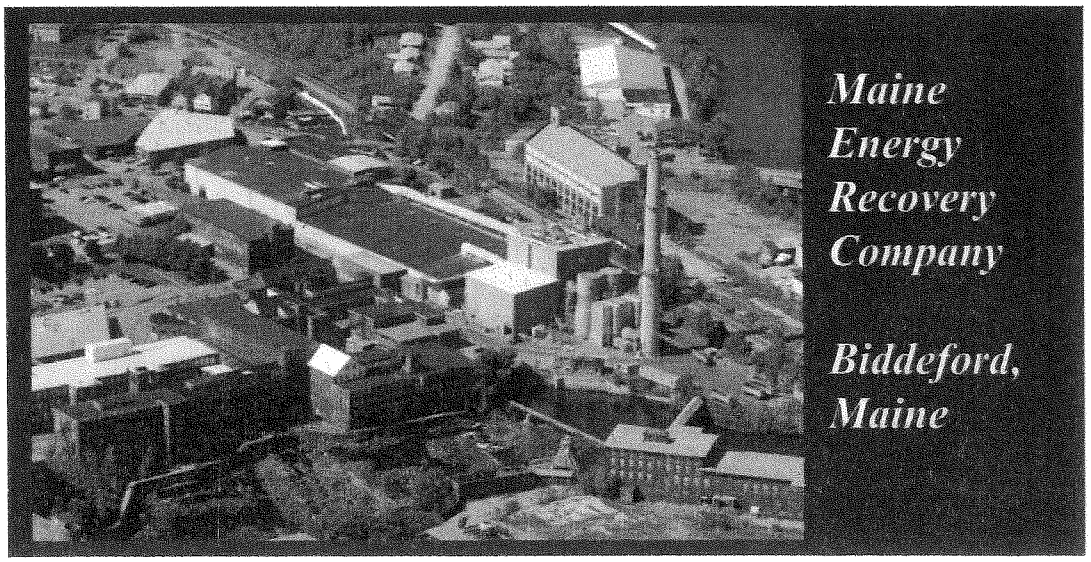
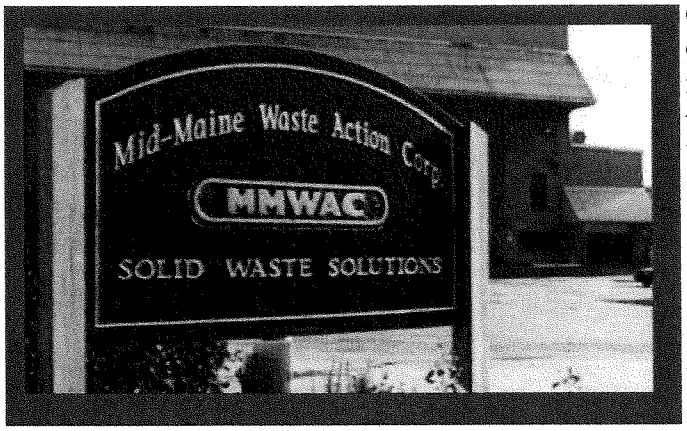


REGIONAL ECONOMIC IMPACT ANALYSIS

Tables 7 to 10 present a summary of the results from an analysis of the regional economic contributions of the individual waste-to-energy facilities. The "region" of interest is the county where the facility is located. In each of the tables, the direct impacts are the revenue, employment and income that are associated with the facility's annual operations. The multiplier effects of these facilities are estimated using separate county-level economic impact (IMPLAN) models.

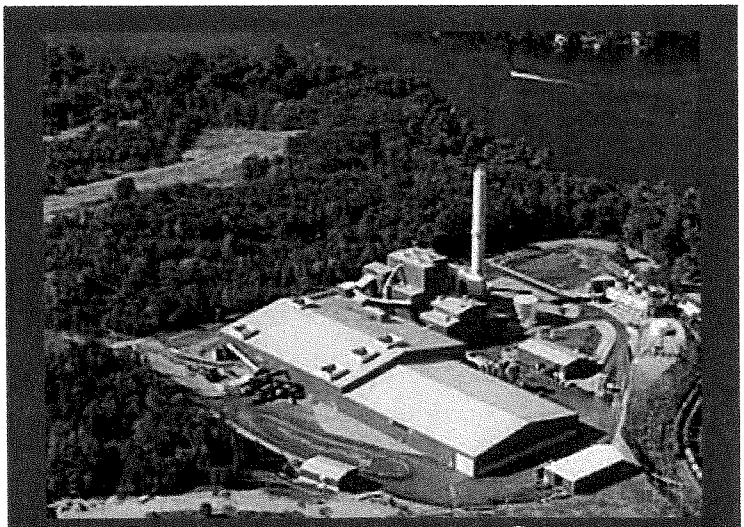


The ecomaine facility, located in Portland (Cumberland County), generates about $23.6 million in annual revenue, and it directly employs 46 workers that receive $4.2 million in labor income per year. Including multiplier effects, ecomaine has a county-level annual economic contribution of an estimated $34.2 million in revenue, 128 full- and part-time jobs, and $7.6 million in labor income.

The Maine Energy Recovery Company (MERC) reports annual revenues of $23.5 million, and the Biddeford-based (York County) facility directly employs 79 workers that receive $6.4 million in labor income. MERC has a total county-level annual economic contribution, including multiplier effects, of an estimated $32.1 million in revenue, 167 full- and part-time jobs, and $9.2 million in labor income.

Located in Auburn (Androscoggin County), the Mid-Maine Waste Action Corporation (MMWAC) brings in $6.3 million in revenue per year, and the facility directly employs 28 workers that receive $2.4 million in labor income. Including multiplier effects, MMWAC's total county-level annual economic contribution is an estimated $10.5 million in revenue, 66 full- and part-time jobs, and $3.9 million in labor income.

The Penobscot Energy Recovery Company (PERC), located in Orrington (Penobscot County), generates $40.0 million in annual revenue, and it directly employs 75 workers that receive $6.5 million in labor income. PERC has a county-level annual economic contribution, accounting for multiplier effects, of an estimated $52.9 million in revenue, 188 full- and part-time jobs, and $10.8 million in labor income.



Penobscot Energy Recovery Company
Orrington, Maine

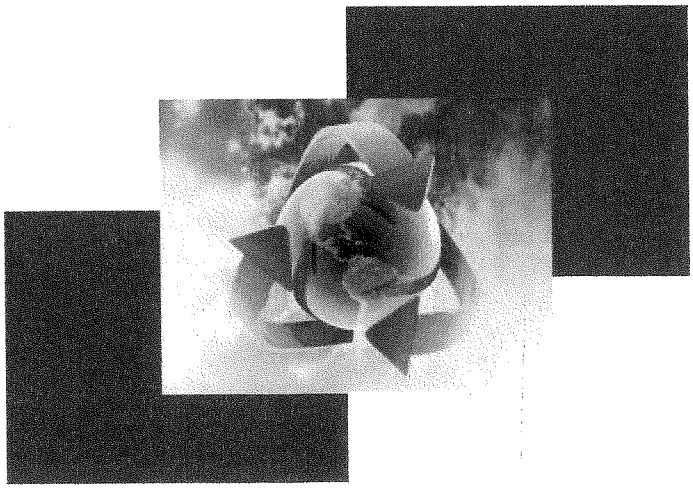
The total annual revenue, including multiplier effects, associated with the regional economic impacts of the four waste-to-energy facilities ranges from a low of $10.5 million (MMWAC) to a high of $52.9 million (PERC). Overall, the combined regional economic contribution of the four facilities –on their respective counties –is $129.6 million in revenue, 549 full- and part-time jobs, and $31.6 million in labor income. These combined regional economic impacts are less than the waste-to-energy sector's statewide economic contribution

(Table 2) because the state-level analysis captures the economic activity occurring in the four counties where facilities are located as well as the rest of Maine, where the industry impacts the economy through the purchases made by businesses and workers related to the waste-to-energy sector.

Although the county-level waste-to-energy industry employment multipliers exceed 2.0 for all of the facilities, these estimated figures –as well as the revenue and labor income multipliers – differ somewhat across regions of the state. In the case of the employment multipliers, the variation across counties is explained by differences in the productivity of workers across the four facilities, as well as differences in the size of the economies in the counties where the waste-to-energy facilities are located. As noted above, the amount of revenue per worker (i.e., a worker's productivity) and the amount and variety of goods and services available locally –which increases the extent to which businesses and workers can make purchases in the region –tend to increase the size of a facility's county-level employment multiplier.

SUMMARY

The Maine waste-to-energy industry is made up of four facilities, located in Auburn, Biddeford, Orrington and Portland. These plants directly support a combined 228 jobs, which provide $19.5 million in labor income (an average of $85,691 per worker). An economic impact analysis shows that, including multiplier effects, the Maine waste-to-energy sector has a total statewide economic contribution of an estimated $137.0 million in revenue, 597 full- and part-time jobs, and $33.9 million in labor income (an average of $56,713 per worker). The impacts of the waste-to-energy facilities extend across all industries of the Maine economy, through the spending of businesses and workers related to the sector. Based on revenue figures, the industries that are most heavily impacted by the spending of businesses and workers related to the waste-to-energy facilities include Finance and Insurance (due to the spending of businesses and workers); Healthcare and Social Assistance (mainly due to the spending of workers); and Professional, Scientific, and Technical Services (mainly due to the spending of businesses). The impacts of the waste-to-energy sector extend across all regions of Maine, with the largest impacts felt in the four counties where facilities are located.



STATEWIDE ECONOMIC CONTRIBUTION OF MAINE'S WASTE-TO-ENERGY SECTOR

This study was conducted under a private consulting contract with the Maine Waste-to-Energy Working Group.

Todd Gabe is a Professor of Economics at the University of Maine. Dr. Gabe can be contacted via email at todd.gabe@yahoo.com

Appendix B

Pan Atlantic SMS Group 51st Omnibus Poll

Spring 2013

Question: Which of the Following Methods should Maine use to Dispose of Waste in the Future?

Pan Atlantic SMS Group
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PAN ATLANTIC SMS GROUP
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"Closest in predicting the actual results of the Governor's race and the 1st Congressional District race in 2010"

Bangor Daily News
"Most Accurate Pollster on Maine's 2010 Gubernatorial Race"

Down East MAINE AT ITS BEST
"Maine's Best Pollster 2008"

Table of Contents

I. Background

- Pan Atlantic SMS Group is a Maine based, independent market research and consulting firm which is currently in its 28th year of successful operation.

- This Omnibus Poll is the 51st poll in a series conducted by Pan Atlantic SMS Group on public policy, business, economic, technology, and lifestyle issues. Because we have conducted this poll on a frequent basis over a long time period (since 1996), we are in a unique position to provide reliable benchmarking on a range of important issues.

- Media or other use of the information contained in the Pan Atlantic SMS Group Omnibus Poll™ must identify the source of information.

- All questions reported on herein are non-proprietary and were not commissioned by any party other than Pan Atlantic SMS Group.

- For further information, please contact Patrick O. Murphy, President of Pan Atlantic SMS Group, at (207) 871-8622 or by email at pmurphy@panatlanticsmsgroup.com.

II. Methodology

- The 51st Pan Atlantic SMS Group Omnibus Poll™ was conducted between March 11th and March 16th, 2013. This independent survey data is being released to the Maine media in the public interest.

- A randomly selected, stratified statewide sample of **403** Maine residents was interviewed by telephone. Each of Maine's two Congressional Districts are represented by approximately half of the sample.

- The survey was administered only to those who fulfilled the following criteria:

  - Are ages 18 and older
  - Do not, nor does anyone in their household, work for a market research, advertising or media firm
  - Are registered to vote in Maine

- This independent poll was conducted by telephone, at our in-house interviewing center, by Pan Atlantic's team of experienced interviewers. No outside interviewer sources were used. The sample used comprised a mix of landlines and cell phones to ensure representative age and cell phone only vs. landline user segment distribution.

II. Methodology

- It should be noted that figures may not always equal 100.0 percent due to the rounding of decimals.
- The sample was stratified statewide based on the 2010 U.S. Census of Population and Housing data. The sample size has statistical significance of ± 4.9 percent at the 95 percent confidence level. This means that if the survey were to be repeated, 95 times out of 100 the results would reflect the results of this survey within the ± 4.9 percent margin of error.
- The results are broken out by various demographic subsamples, including Congressional District, political party affiliation, age, and gender. The margins of error for each of the two CDs is ± 6.93 percent at the 95 percent confidence level.
- Finally, we note that as with all surveys, these results are indicative of public opinion at a singular point in time.

III. POLL RESULTS

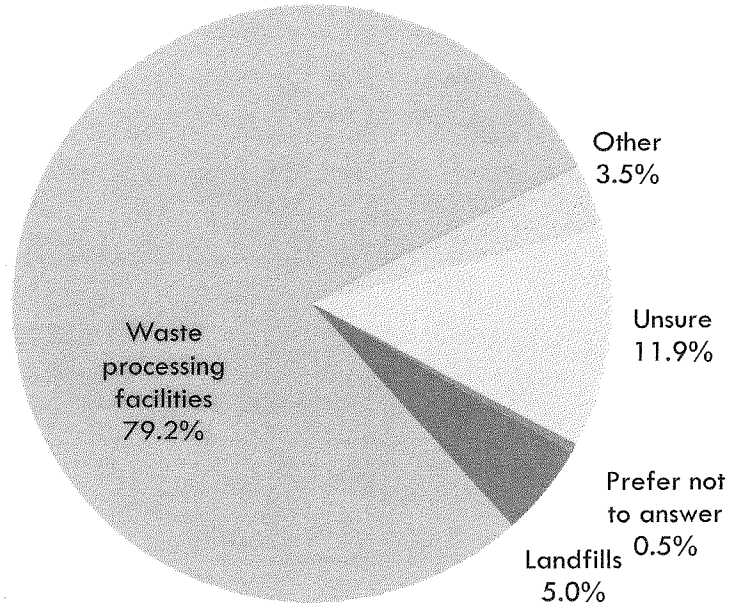
Proprietary Results for Doyle & Nelson, Attorneys at Law

Mainers agree that waste processing facilities that reduce landfill waste is preferable to landfills.

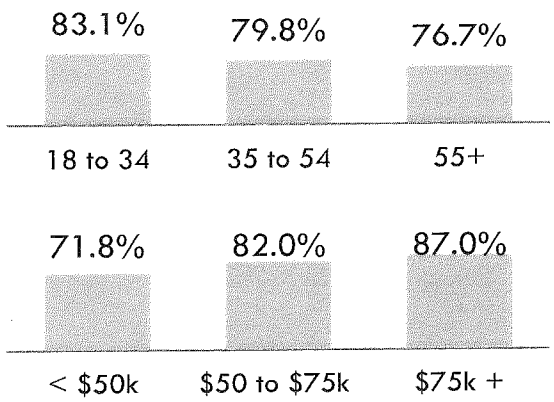
Which of the following methods should Maine use to dispose of its waste in the future?

-Via landfills

-Via waste processing facilities which reduce the amount of waste going to landfills by 90%



Younger Mainers and those with high income levels have the highest support for waste processing facilities over landfills.



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IV. POLL DEMOGRAPHIC DATA

Poll Demographic Data

CONGRESSIONAL DISTRICT	
CD1	49.9%
CD2	50.1%

POLITICAL AFFILIATION	
Democrats	32.8%
Republicans	32.8%
Independents / Unenrolled	32.0%
Other	1.7%
Refused	0.7%

AGE	
18 to 34	16.1%
35 to 54	46.7%
55+	37.2%

GENDER	
Female	50.9%
Male	49.1%

2012 HOUSEHOLD INCOME	
$50,000 or less	29.0%
$50,000 to <$75,000	22.1%
$75,000 or more	34.3%
Unsure/Prefer not to answer	14.7%

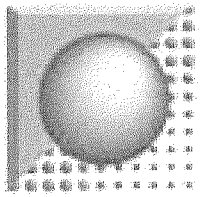
10

V. CROSS TABULATION TABLES

Which of the following methods should Maine use to dispose of its waste in the future?

		Congressional District		Gender		Age			2012 HH Income				Political Party Affiliation				Children in HH	
	Total	CD 1	CD 2	Female	Male	18 to 34	35 to 54	55+	< $50K	$50K < $75K	$75K+	Don't know / Refused	Democrat	Republican	Independent	Other	Yes	No
Total	403	201	202	205	198	65	188	150	117	89	138	59	132	132	129	10	204	199
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Landfills	20	11	9	5	15	4	8	8	6	6	6	2	5	6	9		8	12
	5.0%	5.5%	4.5%	2.4%	7.6%	6.2%	4.3%	5.3%	5.1%	6.7%	4.3%	3.4%	3.8%	4.5%	7.0%		3.9%	6.0%
Waste processing facilities	319	160	159	165	154	54	150	115	84	73	120	42	103	108	100	8	164	155
	79.2%	79.6%	78.7%	80.5%	77.8%	83.1%	79.8%	76.7%	71.8%	82.0%	87.0%	71.2%	78.0%	81.8%	77.5%	80.0%	80.4%	77.9%
Other	14	8	6	6	8	3	7	4	9	3	1	1	3	5	6		8	6
	3.5%	4.0%	3.0%	2.9%	4.0%	4.6%	3.7%	2.7%	7.7%	3.4%	.7%	1.7%	2.3%	3.8%	4.7%		3.9%	3.0%
Don't know	48	20	28	28	20	4	21	23	18	7	11	12	21	12	14	1	23	25
	11.9%	10.0%	13.9%	13.7%	10.1%	6.2%	11.2%	15.3%	15.4%	7.9%	8.0%	20.3%	15.9%	9.1%	10.9%	10.0%	11.3%	12.6%
Refused	2	2		1	1		2					2		1		1	1	1
	.5%	1.0%		.5%	.5%		1.1%					3.4%		.8%		10.0%	.5%	.5%

Pan Atlantic SMS Group (March 2013)



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