Energy Gone to Waste: A Case for Promoting Waste-to-Energy Power Generation Over Landfills

By David Glanton*

Waste is worse than loss. The time is coming when every person who lays claim to ability will keep the question of waste before him constantly.

Thomas Edison[1]

The word which gives the key to the national vice is waste. And people who are wasteful are not wise . . . . In order to transmute energy to higher and more subtle levels one must first conserve it.

Henry Miller[2]

"Solid wastes" are the discarded leftovers of our advanced consumer society. This growing mountain of garbage and trash represents not only an attitude of indifference toward valuable natural resources, but also a serious economic and public health problem.

Jimmy Carter[3]

Prudent Americans have registered concern for years regarding the dangers of being a wasteful society. Wasteful habits impact both our supply of energy and the environment.[4] These habits have resulted in an ever-increasing accumulation of trash. For example, the Fresh Kills landfill in New York City is one of only two man-made structures recognizable from space by the naked eye.[5]

Consumption is a perpetual concern for any community. It implicates two responsibilities: (1) generating enough energy to support the community's standard of living and (2) managing the waste that is a by-product of our consumer society. One solution that addresses both concerns is Waste-to-Energy power generation ("WTE"), by which municipal solid waste ("MSW') is incinerated to produce electricity, via steam generators.[6] Despite WTE's ability to transform a growing waste problem into a renewable energy solution, no new plants have been built since 1995[7] and landfills remain the predominant system of waste management.

According to a 2008 study by Columbia University, Americans amass 389.5 million tons of MSW per year[8] or 7.1 pounds per person per day.[9] Over the course of a lifetime, the average American will generate approximately 102 tons of waste[10]—enough to fill almost 40 thousand

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1. Jacob M. Braude, Speaker's Desk Book of Quips, Quotes, and Anecdotes 289 (1963).
2. Henry Miller, The Air-Conditioned Nightmare 118 (1945).
3. The Environment Message to the Congress from President Jimmy Carter (May 23, 1977), *available at* http://www.presidency.ucsb.edu/ws/?pid=7561#axzz2fUOHcuj3.
4. It is estimated that "10% of the world's oil supply is used to make and transport disposable plastics." Edward Humes, Garbology: Our Dirty Love Affair With Trash 15 (2012).
5. The other landmark is the Great Wall of China. *Id.* at 11–12.
6. Markus G. Puder, *Trash, Ash, and the Phoenix: A Fifth Anniversary Reviewing of the Supreme Court's City of Chicago Waste-to-Energy Combustion Ash Decision,* 26 B.C. Envtl. Aff. L. Rev. 473, 475 (1999).
7. *Energy Recovery From Waste*, U.S. Envtl. Prot. Agency, http://www.epa.gov/wastes/nonhaz/municipal/wte/index.htm (last updated July 24, 2012) [hereinafter U.S. EPA, *Energy Recovery From Waste*].
8. Humes, *supra* note 4, at 7 (*citing* R. van Haaren, N. Themilis, & N. Goldstein, Biocycle, The State of Garbage in America: 17th Nationwide Survey of MSW Management in the U.S. (Oct. 2010)). EPA, however, estimates that total MSW production is only 250 million tons. Office of Resource Conservation and Recovery, U.S. Envtl. Prot. Agency, Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Tables and Figures for 2010 Table 29 (Dec. 2011) [hereinafter U.S. EPA, MSW Generation, Recycling, and Disposal], *available at* http://www.epa.gov/osw/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf.
9. Humes, *supra* note 4, at 144.
10. Humes, *supra* note 4, at 4.

cubic feet[11] or roughly twice the size of the average American home.[12]

The majority of our collective waste—270 tons—is discarded in landfills every year.[13] This practice is harmful to both human health and the environment. Large landfills produce significant amounts of greenhouse gases[14] and may leak as much as 2 million gallons of hazardous sludge into the earth every day.[15] The dangers posed by landfills, however, are not the only concerns—our waste graveyards are a forgotten resource, locking away abundant energy.

The environmental cost of relying on fossil fuels to meet energy needs is profound. In 2010, American energy consumption generated 5,916 million metric tons of carbon dioxide (CO_2) emissions[16] and all energy-related activities produced more than 85% of U.S. greenhouse gases in 2011.[17] Fossil fuel combustion was the single largest contributor to these emissions, and coal mining the fourth largest.[18]

Using WTE in place of landfills would generate 133 billion kWh of electricity per year.[19] This new energy generation could reduce American reliance on coal by 8%.[20] Furthermore, 3 million pounds of greenhouse gas emissions would be avoided for every kilowatt-hour generated by WTE instead of fossil fuels.[21] Without WTE, greenhouse gas emissions will grow as energy demands increase on an annual basis.[22]

WTE has not been promoted as the optimal solution to our waste management problems despite policy-makers' concerns over the growth in energy consumption and waste generation.[23] In recent years, controversy surrounding WTE projects has stifled new development.[24] The three main concerns are that (1) WTE plants cause significant pollution through the emission of greenhouse gases, (2) WTE plants do not produce renewable energy and harm recycling efforts, and (3) WTE is too expensive, and therefore, not practical.[25] As will be shown below, the first two concerns are unfounded, and the third, while sometimes valid, can be mitigated by federal incentives.

This Note dispels the misconceptions surrounding WTE and provides support for its use as a preferable means of waste disposal. Furthermore, this Note explores solutions to improve the economics of building new WTE plants. Specifically, this Note argues for the single classification of WTE as a first-tier renewable energy technology and proposes amendments to the Energy Policy Act of 2005 that would allow new WTE plants to be eligible for the same tax credits and loan guarantees as other renewable technologies. Part I provides background on the history of WTE, its regulation, and the current incentives for its development. Part II details the current waste management paradigm in the United States and why it is unlikely to change, absent concerted efforts to promote WTE. Part III provides the rationale for supporting WTE as both the optimal waste management solution and a practical source for renewable energy production. Part IV proposes that (a) the use of WTE be favored over the use of landfills, and (b) WTE be given equal legal status to other renewable energy sources for the purposes of promoting renewable energy. Part V addresses the concerns with WTE and the arguments against its adoption. Part VI concludes with a brief summary of the arguments in favor of WTE and the regulatory changes that would encourage greater WTE deployment.

11. According to EPA, uncompacted MSW may have a weight-to-volume ratio as small as approximately 150 pounds per cubic yard. Solid Waste and Emergency Response, U.S. Envtl. Prot. Agency, EPA530-R-011, Measuring Recycling: A Guide for State and Local Governments 62 (Sept. 1997), *available at* http://www.epa.gov/osw/conserve/tools/recmeas/docs/guide.pdf. By using this conversion factor, and converting short tons to pounds, and cubic yards to cubic feet, 102 short tons is equivalent to approximately 36,720 cubic feet.
12. In 2010, the average new home size in the United States was 2,392 square-feet. U.S. Census Bureau, Median and Average Square Feet of Floor Area in New Single-Family Houses Completed by Location (2010), *available at* http://www.census.gov/const/C25Ann/sftotalmedavgsqft.pdf. Assuming eight-foot ceilings, the volume of the average house would be 19,136 cubic feet.
13. *See* Rob van Haaren, Nickolas Themelis, & Nora Goldstein, BioCycle, The State of Garbage in America, at Table 1 (Oct. 2010).
14. Carson Bennett, *Landfill Gas-to-Energy in the U.S. and U.K.: An Analysis of Differing Policy Objectives Regarding Landfill Gas and Accompanying Regulations and Incentives,* 23 Geo. Int'l Envtl. L. Rev. 531, 533 (2011).
15. Heather P. Behnke, Kathleen M. Bennett, & Amy L. Du Vall, *Recycling: Anything but Garbage,* 5 Buff. Envtl L.J. 101, 103–04 (1997).
16. Office of Energy Statistics, U.S. Energy Info. Admin., DOE/EIA-0384(2011), Annual Energy Review 2011 303, Table 11.1 (Sept. 2011).
17. U.S. Envtl. Prot. Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011 3-1 (Apr. 2013), *available at* http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html.
18. *Id.*
19. The average WTE facility produces 550 kWh per ton of MSW. *Air Emissions From MSW Combustion Facilities*, U.S. Envtl. Prot. Agency, http://www.epa.gov/wastes/nonhaz/municipal/wte/airem.htm#7 [hereinafter U.S. EPA, *Air Emissions From MSW Combustion Facilities*] (last updated July 24, 2012). The Columbia/Bio-Cycle study suggests that approximately 270 million tons of waste is sent to landfills each year. *See* Haaren, Themelis & Goldstein, *supra* note 13, at Table 1.
20. Coal generated 1,734 kWh in 2011. U.S. Energy Info. Admin., *supra* note 16, at 224, Fig. 8.2a.
21. *See* Ted Michaels, Energy Recovery Council, Waste Not, Want Not: The Facts Behind Waste-to-Energy 5 (Apr. 2009) [hereinafter Michaels, Waste Not, Want Not], *available at* http://www.wte.org/userfiles/file/Waste%20Not%20Want%20Not.pdf.
22. From 1960–2010 total energy consumption in America more than doubled, jumping from approximately 45–98 quadrillion BTU. U.S. Office of Energy Statistics, *supra* note 16, at 5, Table 1.1.
23. The Congressional Research Service notes: "Reducing energy consumption by conservation and by increased efficiency of energy use has been a major component of policy since the first energy crisis in the 1970s." Carl E. Behrens, Cong. Research Serv., Energy Policy: Election Year Issues and Legislative Proposals 2 (Sept. 24, 2012); *See, e.g.,* U.S. Envtl. Prot. Agency, EPA530-R-99-034 1, National Source Reduction Characterization Report for Municipal Solid Waste in the United States (Nov. 1999) ("In February 1989, the [EPA] *Agenda for Action* called for a new solid waste management ethic") (internal quotations omitted).
24. *See, e.g.,* Fern Shen, *Battle Over South Baltimore Trash Incinerator Re-igniting,* Baltimore Brew (Aug. 30, 2012), *available at* http://www.baltimorebrew.com/2012/08/30/battle-over-proposed-south-baltimore-trash-incinerator-re-igniting/ (last visited Sept. 16, 2012) (discussing opposition to a new plant); Curt Guyette, *Detroit Incinerator's Sisyphean Battle,* Huffington Post (Nov. 11, 2011), http://www.huffingtonpost.com/2011/11/30/detroit-incinerators-sisy_n_1121079.html (discussing opposition to financial support for an existing facility).
25. Ananda Lee Tan, Global Alliance for Incinerator Alternatives, Waste-to-Energy: Myths vs. Facts 1-2 (2010), *available at* http://www.no-burn.org/downloads/Waste-to_Energy%20Myths%20and%20Facts%20Ph.pdf. The cost of a new WTE facility ranges from $50–$280 million, and its operation can cost twice as much as that of a landfill. *Trash Incineration (Waste-to-Energy) Systems,* Sustainable Cities Inst., http://www.sustainablecitiesinstitute.org/view/page.basic/class/feature.class/Lesson_Trash_Incineration (last visited Sept. 22, 2013). The cost of building and fueling the world's largest WTE facility has caused Detroit residents to protest its operation for more than two decades. *See* Brad van Guilder, *Detroit Waste Incinerator: Dirty and Expansive,* Ecology Ctr., http://www.ecocenter.org/trash-recycling/detroit-waste-incinerator-dirty-and-expensive (last visited Sept. 22, 2013).

I. Background

A. History of WTE

The practice of burning trash is not new to America—New York opened the United States' first trash incinerator in 1885.[26] However, burning waste became disfavored over time due to air pollution caused by early incinerators. For example, Los Angeles city officials chose to abandon incineration after the city developed a notorious smog problem, due in part to backyard trash incineration, a common practice during the 1950s and 1960s.[27] Today, the western region of the United States contains only eight of the eighty-six operational WTE projects nationwide, evidence of the long-lasting negative perception created by these earlier events.[28]

B. WTE Today

Currently, forty of the eighty-six WTE plants in the United States are located in the densely populated Northeast, where landfill space is limited.[29] These plants operate by burning MSW in a combustion chamber, after sorting out hazardous waste and recyclables, to produce heat, which powers a steam turbine to generate electricity.[30] Consequently, the MSW is reduced to ash, equal to 15–25% of its pre-incineration weight.[31]

Each year WTE delivers as much as 2.7 million kW of baseload[32] electricity to the grid and processes more than 28 million tons of MSW.[33] This production results in the avoidance of 28 million tons of greenhouse gas emissions per year, such that each ton of MSW burned in WTE plants avoids one ton of greenhouse gas emissions.[34] Due to this mitigation, in 2010, a Florida power plant became the first WTE facility to earn carbon credits for its role in the reduction of greenhouse gas emissions.[35]

C. Cleaning Up With Regulation

Today's WTE facilities feature significant improvements from those of years past.[36] Much of the controversy surrounding the earlier WTE power plants related to the emission of dioxins,[37] not CO_2.[38] In the short-term, dioxin emissions are likely more dangerous to human health than the climate change contributor CO_2. Dioxins have been linked to cancer and a variety of respiratory diseases.[39] Though concerns relating to the release of these hazardous particles are valid, they should not be associated with modern WTE plants, which are subject to regulations that limit emissions.

Pursuant to the 1990 amendments to the Clean Air Act, the Environmental Protection Agency ("EPA") was required to promulgate stricter air toxin emissions standards for WTE facilities.[40] Specifically, WTE facilities must conform to Maximum Achievable Control Technology ("MACT") standards.[41] Operators have retrofit WTE plants with advanced filtration technology to comply with increasingly strict emissions standards.[42] Dixon emissions decreased 99% between 1990 and 2005 as a result of these filtration systems.[43] EPA reported in a 2007 memorandum that the effect of the "MACT retrofits has been outstanding," resulting in only 15 grams of dioxin emissions nationwide in 2005.[44] To put this statistic in perspective, far more dioxin is released from the use of home fireplaces and barbeques than is from WTE facilities.[45]

II. The Status Quo: A Land Filled With Garbage

A. The Hazards of Trash Put to Waste

Despite the improvements in WTE technology, nearly 70% of MSW is buried in landfills.[46] It may not yet be economical to repurpose all of our waste, but burying a fortune in raw materials and potential energy is not the answer. Landfills impose significant costs on the environment. Despite regulation pursuant to the Resource Conservation and Recovery Act of 1976 ("RCRA"), landfills are far from being

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26. *Municipal Solid Waste; Basic Information,* U.S. Envtl. Prot. Agency (July 24, 2012), http://www.epa.gov/wastes/nonhaz/municipal/wte/basic.htm [hereinafter U.S. EPA, *MSW Basic Information*].
27. Humes, *supra* note 4, at 47–52.
28. U.S. EPA, MSW Generation, Recycling, and Disposal, *supra* note 8, at Table 27.
29. *Id.*
30. *Id.*
31. *Id.*
32. A power source is defined as baseload only if its utilization rates are greater than 70%. Utilities purchase a majority of electricity from baseload sources in order to consistently meet consumer demands. *See generally* Part III.B.
33. Ted Michaels, Energy Recovery Council, An Overview of Waste-to-Energy in the US Today 1 (Sept. 2012) [hereinafter Michaels, An Overview of Waste-to-Energy] (noting that a 2010 Columbia/BioCycle study estimates sixty-nine percent of waste is landfilled), *available at* http://www.ct.gov/deep/lib/deep/waste_management_and_disposal/solid_waste/transforming_matls_mgmt/gov_recycling_work_group/energy_recovery_council_presentation_091112.pdf.
34. One ton of greenhouse gas emissions are avoided for each ton of MSW processed by WTE as opposed to being buried in a landfill. U.S. EPA, *Air Emissions From MSW Combustion Facilities, supra* note 19; Kate Adams & Brian D. Israel, *Breaking the Logjam: Environmental Reform for the New Congress and Administration,* 17 N.Y.U. Envtl. L.J. 703, 716 (2008).
35. Shannon Crawford, The Solid Waste Association of North America, Waste-to-Energy Facilities Provide Significant Economic Benefits 3 (Jan. 9, 2012), *available at* http://swana.org/portals/Press_Releases/Economic_Benefits_WTE_WP.pdf.
36. *See* U.S. EPA, *MSW Basic Information, supra* note 26.
37. Dioxins are chemical compounds that are known to cause cancer. Salman Zafar, *Negative Impacts of Incineration-Based Waste-to-Energy Technology,* Alternative Energy (Sept. 20, 2008), http://www.alternative-energy-news.info/negative-impacts-waste-to-energy/.
38. U.S. EPA, *MSW Basic Information, supra* note 26.
39. Zafar, *supra* note 37.
40. Clean Air Act Amendments of 1990, Pub. L. No. 101-159, tit. III, §305(a) (1990) (amending CAA §129) (codified as amended at 42 U.S.C. §7429).
41. 42 U.S.C. §7429(a)(2).
42. *See* U.S. Envtl. Prot. Agency, Memorandum: Emissions From Large and Small MWC Units at MACT Compliance 1 (2007) [hereinafter U.S. EPA, Memorandum].
43. *Id.* at 1.
44. *Id.*
45. Elisabeth Rosenthal, *Europe Finds Clean Energy in Trash, But U.S. Lags,* N.Y. Times (Apr. 13, 2010), at A1, *available at* http://www.nytimes.com/2010/04/13/science/earth/13trash.html?pagewanted=all&_r=0.
46. *See* Michaels, An Overview of Waste-to-Energy, *supra* note 33, at 4 (noting that a 2008 Columbia/BioCycle study estimates landfilling at 69%).

pollution free.[47] Under RCRA, landfills built after 1994 are required to use liners and implement a groundwater monitoring system to prevent water contamination.[48] These regulations have not been entirely successful, however,[49] and do not require liners for small or preexisting sites.[50] Every day, landfills continue to leak leachate, a hazardous sludge that poisons freshwater sources.[51]

Leachate is not the only harmful substance brewed in the depths of landfills. As MSW decomposes, greenhouse gases are produced.[52] Landfill gas is composed of 25–50% CO_2 and 50–75% methane.[53] Alarmingly, methane is considered to be at least twenty times more potent as a greenhouse gas than CO_2.[54] Though large landfills are required to implement systems for capturing the gas,[55] up to 40% of the gas escapes regardless of preventative measures.[56] These emissions account for 16% of the total methane emissions in the United States.[57] Significantly, emissions continue spewing for up to thirty years after a landfill closes.[58] Though landfill gas can be combusted to generate electricity, few U.S. landfills have implemented the necessary systems.[59]

B. Choosing a Waste Management Solution

Landfills continue to be a cornerstone of waste management systems in the United States, despite their harmful nature. States have typically chosen to continue using landfills because building new WTE facilities is relatively expensive. Most plants cost at least $100 million.[60] New landfills may be half expensive as a WTE plant when considering the cost of construction, permitting, operating, and overhead.[61]

Recognizing the dangers posed by landfills, some communities have discontinued using them within their borders, only to send MSW to landfills in distant states. New York City, for example, began exporting its waste to Virginia, Pennsylvania, and Ohio after the city shuttered its landfills but failed to implement WTE.[62] New York is now paying more for trash removal than it would have were WTE adopted.[63] Not all communities have to make 400-mile hauls (the distance from New York to Virginia), so the upfront cost of WTE may prove too much for municipalities that export waste at less cost. Unfortunately, as the situation in New York demonstrates, WTE suffers from a "not in my back yard" problem, premised on misconceptions about WTE. For this reasons, some communities continue to choose landfills—at home or out of state—over WTE, even if at a premium.[64]

C. Second-Class Treatment: WTE Misunderstood

Policymakers in the United States have not done enough to make WTE a more attractive investment for communities and private operators. Unfortunately, an incorrect public perception that waste incineration is worse for the environment than landfills has hampered government support and new development of WTE facilities. Federal- and state-level waste-management and energy policies are flawed because they do not favor WTE over landfills and they do not value WTE's electricity-generating potential as equal to other renewable energy sources. Specifically, EPA's Waste Hierarchy, the Energy Policy Act of 2005 ("EPACT-05"),[65] and renewable energy portfolios implemented by the states, all give WTE a lesser status than is deserved.

1. Waste Hierarchy

The EPA Waste Hierarchy is a guideline that ranks waste management strategies in terms of their environmental impact.[66] The primary concern with the EPA Waste Hierarchy is that WTE is not favored over the use of landfills. The Waste Hierarchy treats landfills that capture landfill gas for energy purposes and WTE as equivalent—both are defined as "Energy Recovery," the third most-favored option for waste management.[67] However, more than 20 years ago "a general consensus [had] developed among waste management profes-

47. *History of RCRA,* U.S. Envtl. Prot. Agency, http://www.epa.gov/osw/laws-regs/rcrahistory.htm (last updated July 30, 2013).
48. 40 C.F.R. §§258.40(a)(2), 258.51–53 (Jul 1, 2011).
49. *See* G. Fred Lee & Anne Jones-Lee, *Superfund Site Remediation by On-Site RCRA Landfills: Inadequacies in Providing Groundwater Quality Protection,* 2 (May 1996) (stating that "significant deficiencies in RCRA Subtitle D landfills in preventing groundwater pollution by waste-derived constituents . . . represent a threat"), *available at* http://www.gfredlee.com/HazChemSites/eia.pdf.
50. 40 C.F.R. §258.1(c)–(d)(1), (f)(1) (July 1, 2011).
51. Ashley A. Allred, *Solutions to a Stinky Problem: Congressional Legislation to Promote the use of Cloth Diapers,* 19 S.J. Agric. L. Rev. 65, 71 (2009–2010).
52. Landfills produce approximately 22% of methane emissions in the United States. Bennett, *supra* note 14, at 533.
53. *Id.* at 532.
54. John Rather, *Tapping Power From Trash,* N.Y. Times, Sept. 14, 2008, at K3, *available at* http://www.nytimes.com/2008/09/14/nyregion/nyregionspecial2/14Rmethane.html.
55. *LFG Energy Projects,* U.S. Envtl. Prot. Agency, http://www.epa.gov/lmop/faq/lfg.html#11 (last updated Sept. 18, 2013). As much as 31,000 cubic feet of this gas is generated every minute at larger landfills.
56. U.S. Envtl. Prot. Agency, LFG Energy Project Development Handbook, 1–8 (2011) [hereinafter Landfill Gas Basics], *available at* http://www.epa.gov/lmop/documents/pdfs/pdh_chapter1.pdf.
57. *Greenhouse Gas Emissions, Methane Emissions*, U.S. Envtl. Prot. Agency, http://epa.gov/climatechange/ghgemissions/gases/ch4.html (last updated June 14, 2012).
58. Bennett, *supra* note 14, at 543.
59. *See id.* at 542.
60. *Basic Information About Energy Recovery From Waste: Municipal Solid Waste,* U.S. Envtl. Prot. Agency, http://www.epa.gov/wastes/nonhaz/municipal/wte/basic.htm (last updated July 24, 2012); *see also* Behnke, *supra* note 15, at 105–06, 108 (noting that a $535 million price tag on a new incinerator contributed to the cities decision to abandon the project).
61. Susan A. Thorneloe et al., *Application of the U.S. Decision Support Tool for Materials and Waste Management,* 27 Int'l J. Integrated Waste Mgmt. Sci. & Tech. 1006, 1013 (2007), *available at* http://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=157025.
62. Behnke, *supra* note 15, at 138. Though many in Virginia have taken exception to becoming New York City's trashcan, the U.S. Constitution prohibits the State from restricting these shipments. Daniel Shean, *The Politics of Trash,* 16 Buff. Envtl. L.J. 55, 57 (2008–2009).
63. N.Y. Citizens Budget Comm'n, Taxes in, Garbage Out: The Need for Better Solid Waste Disposal Policies in New York City, at i (May 2012), *available at* http://www.cbcny.org/sites/default/files/REPORT_SolidWaste_053312012.pdf.
64. Jennifer Giacoppo, *Waste-to-Energy From the Inside,* Earth 911 (Oct. 25, 2010), http://earth911.com/news/2010/10/25/waste-to-energy-from-the-inside/.
65. Energy Policy Act of 2005, 26 U.S.C. §45; 42 U.S.C. §16513.
66. *Solid Waste Management Hierarchy,* U.S. Envtl. Prot. Agency, http://www.epa.gov/osw/nonhaz/municipal/hierarchy.htm (last updated Nov. 15, 2012).
67. Energy Recovery is defined as "the conversion of non-recyclable waste materials into usable heat, electricity, or fuel through a variety of processes," including WTE and landfill gas recovery. U.S. EPA, *Energy Recovery From Waste, supra*

sionals that a hierarchy of waste management options exists" which places WTE above the use of landfills.[68] Despite this consensus, many states have adopted waste hierarchies that substantially align with EPA's, placing WTE and landfill gas recovery on the same level.[69]

2. Renewable Portfolio Standards

WTE's potential for energy generation is also undermined by the poor design of states' renewable portfolio standards ("RPS"), which do not often promote waste incineration. Renewable Portfolio Standards serve as a state's commitment to produce a specific percentage of its energy from qualified renewable sources by a given year.[70] As such, RPS serve as a primary mechanism for states to drive investment in renewable energy.[71] As of January 2012, a majority of states had enforceable RPS.[72] States with enforceable standards have seen considerable gains in the production of renewable energy from qualified sources.[73] A typical RPS includes wind, geothermal, and biomass as qualified renewable energy sources.[74] However, few states have made WTE eligible as qualifying to meet RPS goals.[75] Such policy decisions have significantly hindered investment in new WTE, as RPS are prime drivers for the development of new renewable energy generation.

States often use preferential treatment to distinguish among renewable technologies. For example, some RPS set distinct production goals for a given group of preferred energy sources.[76] These groups are called tiers. Therefore, qualifying WTE as a renewable energy resource under state standards will not guarantee new investment unless WTE is placed in the top tier.

One characteristic that is common among tiered systems is that WTE falls at the bottom.[77] In Connecticut for example—where WTE is a Tier II resource[78]—20% of the State's commercial electricity must be produced by Tier I renewable source by 2020, whereas only 3% must come from Tier II sources.[79] Notably, Tier II sources like WTE can be avoided altogether if 23% of electricity comes from Tier I sources, allowing Connecticut to rely on fossil fuels for the remainder of their energy needs.[80] Because classification can affect the demand for a particular renewable energy source, the Mayor of Hartford, one of Connecticut's largest cities, has testified in support of reclassifying WTE as Tier I.[81]

3. Federal Incentives for Renewable Energy Production

The federal government, like the states, has given WTE second-class status when it comes to promoting renewable energy generation. Two of the primary ways that the federal government promotes investment in renewable energy are the EPACT-05 authorized Production Tax Credits ("PTC")[82] and loan guarantees.[83] As discussed below, these incentives are not favorable to WTE; thus, new development is unlikely.

The PTC is a financial incentive that places renewable energy on a competitive field with fossil fuels by subsidizing the cost of production.[84] Electricity production that qualifies for PTCs earns credit against future taxes, calculated on a per kilowatt basis, using rates that vary by renewable energy source.[85] Although WTE qualifies for the PTC incentive, it only earns 1.1¢ per kWh, whereas wind, closed-loop biomass, and geothermal energy earn 2.3¢ per kWh.[86] Unfortunately, WTE is treated as equivalent to landfill gas recovery, which is also eligible to receive a 1.1¢ per kWh credit.[87]

Department of Energy ("DOE") loan guarantees also incentivize the development of new renewable energy proj-

note 7. Landfill gas can be captured to generate electricity. *Solid Waste Management Hierarchy*, *supra* note 66.

68. Arnold W. Reitze Jr. & Andrew N. Davis, *Regulating Municipal Solid Waste Incinerators Under the Clean Ari Act: History, Technology and Risks,* 21 B.C. Envtl. Aff. L. Rev. 1, 2–3 (1993). *But see* Steffen Lehmann, *Resource Recovery and Materials Flow in the City: Zero Waste and Sustainable Paradigms in Urban Development,* 11 Sustainable Dev. L. & Pol'y 28, 29 (2010) (opining that WTE is inefficient and "therefore ranks rightly at the bottom of the waste management hierarchy").
69. *See, e.g.,* David Allaway & Peter Spendelow, Or. Dept. of Envtl. Quality, Briefing Paper: Oregon's Solid Waste Hierarchy—Intent and Uses (Sept. 27, 2011), *available at* http://www.deq.state.or.us/lq/pubs/docs/sw/2050vision/BriefingPaperSWHierarchy.pdf; *Local Solid Waste Management Planning,* N.Y. Dept. of Envtl. Conservation, http://www.dec.ny.gov/chemical/47861.html (last visited Apr. 7, 2013); Dep't of Energy & Envtl. Prot., *Solid Waste Management in Connecticut,* State of Conn., http://www.ct.gov/deep/cwp/view.asp?a=2718&q=325464&deepNav_GID=1646%20 (last updated May 15, 2012).
70. *Today in Energy: Most States Have Renewable Portfolio Standards,* U.S. Energy Info. Admin. (Feb. 3, 2012), http://www.eia.gov/todayinenergy/detail.cfm?id=4850.
71. *See* Md. Energy Admin., RPS: Increasing Maryland's In-State Renewable Generation to 20% by 2020 (Apr. 2013), *available at*, http://www.statestat.maryland.gov/gdu/10renewableenergydeliveryplan.pdf.
72. *Today in Energy: Most States Have Renewable Portfolio Standards, supra* note 70.
73. *See* Stephen C. Braverman, *State Renewable Portfolio Standards and the Commerce Clause,* 25 Nat. Resources J. 15, 15 (2010–2011).
74. *Today in Energy: Most States Have Renewable Portfolio Standards, supra* note 70.
75. Paradoxically, some states have included landfill gas recovery as meeting the renewable standard. Braverman, *supra* note 73, at 15.
76. *See* James M. Van Nostrand & Anne Marie Hirschberger, *Implications of a Federal Renewable Portfolio Standard: Will It Supplement or Supplant Existing State Initiatives?,* 41 U. Tol. L. Rev. 853, 855–57 (2010).
77. PJM Envtl. Info. Serv., Comparison of Renewable Portfolio Standards (RPS) Programs in PJM States (Jan. 9, 2013), *available at* http://www.pjm-eis.com/~/media/pjm-eis/documents/rps-comparison.ashx.
78. Conn. Gen. Stat. §16-1(a)(27).
79. Pub. Utils. Regulatory Auth., Dep't of Energy & Envtl. Prot., *Connecticut Renewable Portfolio Standards Overview,* State of Conn. (July 2012), http://www.ct.gov/pura/cwp/view.asp?a=3354&q=415186.
80. *Id.*
81. *See, e.g., An Act Concerning the Reclassification of Trash to Energy Facilities as Class One Renewable Energy Sources: Hearing on H.B. 5118 Before the H. Comm. on the Environment,* 2012 Leg. Sess. (Conn. 2012) (testimony of Mayor Pedro E. Segarra, City of Hartford).
82. Energy Policy Act of 2005, §1301 (codified as amended at 26 U.S.C. §45).
83. *Id.* §§1703, 1705 (codified as amended at 42 U.S.C. §16511-16).
84. *See Renewable Electricity Production Tax Credit (PTC)*, Database of State Incentives for Renewables & Efficiency (Jan. 3, 2013), http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=US13F [hereinafter Database PTC]; Dallas Heltzell, *Wind Industry Hails Tax-Credit Extension,* Boulder County Business Report (Jan. 2, 2013), http://www.bcbr.com/article/20130102/NEWS/130109995&source=RSS.
85. The incentive lasts for 10 years from the date commercial operation begins. 26 U.S.C. §45(a)(2)(A)(ii). Eligibility for the PTC was recently extended to all qualified facilities put in operation by December 2013. American Tax Payer Relief Act of 2012, §407, Pub. L. No. 112-240 (2013) (to be codified as amended at 26 U.S.C. §45).
86. Database PTC, *supra* note 84.
87.

ects by expanding access to capital.[88] Section 1705 of the EPACT-05 guaranteed loans for the rapid deployment of both innovative and commercial renewable energy and electric power transmission projects.[89] WTE is included among the renewable technologies that qualify for this incentive,[90] but in 2011, Congress failed to renew authorization for the section 1705 incentive.[91]

In light of this background, one must consider if federal incentives encouraging the use of WTE are sufficiently meaningful. Capital for new WTE plants may be hard to secure without loan guarantees, and investors may choose to upgrade existing landfills over building WTE plants because they will receive the same incentive for what will likely be a smaller investment. No new WTE facilities have been built in more than a decade.[92] The current system of incentives must be changed.

III. Benefits of Waste to Energy

WTE is an optimal solution for waste management and should be implemented for the following three reasons: (1) WTE facilities will reduce our reliance on the use of landfills; (2) WTE delivers baseload power and will reduce American reliance on coal; and (3) WTE is not dependent on geographical features like other renewable energy sources and can benefit communities in all regions of the United States.

A. Dumping the Landfills

Investing in WTE reduces reliance on landfills. In fact, states with the greatest number of WTE power plants have the fewest landfills.[93] In the Northeast—where landfills are more costly because of high population density[94]—there are six hundred fewer landfills and thirty more WTE power plants than in the more sparsely populated West.[95]

Connecticut will close down its last MSW landfill in 2015, making it the first state to completely abandon the practice.[96] The state was able to achieve this goal, in part, because of its reliance on WTE. Approximately 68% of Connecticut's MSW in 2010 was used for generating energy at the state's six WTE power plants.[97] Combined, these facilities generated approximately 1.27 million MWh of electricity,[98] equivalent to 10% of the state's electricity demand.[99] More than 35 tons of metal was recovered from the MSW ash and the state maintained recycling levels above 24%.[100]

B. Reliability and Baseload Power

Another key benefit of WTE is its ability to operate as a source of baseload power.[101] Only plants that "can generate dependable power to consistently meet [minimum] demand" are considered baseload generating sources.[102] Typically, these plants must be capable of 70% annual utilization rates,[103] also known as a capacity rating. Whether an energy source can generate baseload power is significant because utilities buy at least 35–40% of their electricity from baseload sources.[104]

Coal is currently the primary source of baseload power in the United States.[105] As states reduce their carbon footprints by closing coal-fired power plants, the growth in public transportation and the use of electric vehicles will strain states' abilities to meet baseload demand,[106] if not replaced with electricity from baseload renewable sources. Fortunately, WTE can serve as this baseload power source that reduces American reliance on coal. WTE has a 90% capacity rating,[107] far exceeding the 70% requirement for baseload power. This is unsurprising as there is a "constant need for trash disposal."[108] WTE, unlike other renewable electricity generation, is capable of operating 24 hours a day for practically every day of the year.[109] The significance of this reliability is obvious when considering that WTE maintained power generation during devastating Florida hurricanes.[110]

C. In Support of Local Communities

WTE is also favorable because of its geographical independence and ability to support local communities. A WTE facility does not take up significant space and can be built

88. *U.S. Department of Energy—Loan Guarantees,* Database of State Incentives for Renewables & Efficiency (last updated May 8, 2012), http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US48F [Database Loan Guarantees].
89. 42 U.S.C. §16516.
90. Dep't of Energy, Financial Institution Partnership Program—Commercial Technology Renewable Energy Generation Projects Issued 5 (2009) (listing commercial "trash-to-energy" as one type of qualifying facility), *available at* http://lpo.energy.gov/wp-content/uploads/2010/09/CTRE.pdf.
91. The Department of Energy's authority to enter into §1705 expired on September 30, 2011. 42 U.S.C. §16516(e).
92. *See* U.S. EPA, *Energy Recovery From Waste, supra* note 7 (noting that the last WTE facility was built in 1995).
93. U.S. EPA, MSW Generation, Recycling, and Disposal, *supra* note 8, at Tables 27 & 28.
94. *See* Rosenthal, *supra* note 45.
95. U.S. EPA, MSW Generation, Recycling, and Disposal, *supra* note 8, at Tables 26 & 27.
96. *Recycling at Landfills and Trash-to-Energy Plants,* Conn. Res. Recovery Auth., 2, http://www.crra.org/pages/recy_landfills_wte.htm (last updated Sept. 12, 2011).
97. *See* Conn. Dep't of Energy & Envtl. Prot., Estimates of Connecticut Municipal Solid Waste (MSW) Generated, Disposed, and Recycled FY2010, at 2 (last updated Mar. 28, 2012), *available at* http://www.ct.gov/deep/lib/deep/reduce_reuse_recycle/data/average_state_msw_statistics_fy2010.pdf; Michaels, An Overview of Waste-to-Energy, *supra* note 33, at 9.
98. *Id.* at 9.
99. Humes, *supra* note 4, at 235.
100. Conn. Dep't of Energy & Envtl. Prot., *supra* note 97, at 2.
101. Michaels, Waste Not, Want Not, *supra* note 21, at 7.
102. Matthew Cordaro, *New York Affordable Reliable Electricity Alliance, Understanding Base Load Power: What It Is and Why It Matters,* New York Affordable Reliable Electricity Alliance 2 (Oct. 7, 2008), *available at* http://www.area-alliance.org/documents/base%20load%20power.pdf.
103. Martin Nicholson, The Power Makers' Challenge: And the Need for Fission Energy 77 (2012).
104. Cordaro, *supra* note 102, at 3.
105. *Id.*
106. *See id.*
107. Michaels, Waste Not, Want Not, *supra* note 21, at 7.
108. *Id.*
109. *Id.* The utilization or capcity rating of wind and photovoltaic energy is necessarily limited by weather. As previously noted, traditional base-load sources, such as coal, are less favorable due to their environmental impact. *See infra* Part III.B.
110. Michaels, Waste Not, Want Not, *supra* note 21, at 7. At least three nuclear plants shut down in preparation for Hurricane Sandy.

anywhere. A typical facility[111] in Lee County, Florida, operates on a parcel of land that is approximately 50 acres and generates 50 MW of electricity daily.[112] To produce a corresponding megawatt output from solar facilities, in the best of conditions, at least 250 acres would be necessary.[113] Likewise, for a wind farm to generate 50 MW, it would require more than 120 acres of land.[114] Because WTE power plants require less land, facilities are typically built near large urban centers,[115] which reduces the cost of waste disposal and power transmission.[116]

Unlike wind and solar, which rely on economies of scale in order to be practical,[117] WTE can be sized to fit the community it serves. For example, in 1991, Spokane, Washington built a small facility that only generates 16 MW per day while serving the waste disposal needs of the city's 430,000 ratepayers.[118] The facility cost $110 million,[119] but the city has managed to cover operating expenses and pay off its debt service with a $98 per ton tipping fee.[120] Spokane made the last payment on its bonds in 2011.[121] Now that the facility is debt free, it can charge as little as $38 per ton and still break even.[122] Unfortunately, few communities have decided that the high capital cost is worth the investment, and no new facilities have been built since 1995.[123]

WTE tipping fees are typically lower than $98 per ton—the national average was approximately $67 per ton in 2009.[124] In major cities, where tipping fees at landfills may be more expensive than $67 per ton,[125] WTE should become the obvious choice for waste disposal. Unfortunately, $67 per ton is more than the national average at landfills,[126] which is why Congress must take action to support the financing of new projects.

But even in smaller communities, where landfill use is typically cheaper up front,[127] WTE has significant long-term financial benefits. Unlike exporting waste or importing energy, WTE creates local jobs, which stimulates the local economy.[128] Local residents may also benefit from reduced heating costs as some WTE power plants pipe excess heat directly to nearby homes.[129] Though these investments demand significant up-front capital, a number of these projects have paid off.[130]

Where WTE projects have been successfully managed, local governments have used revenues from power generation to fund recycling programs.[131] In Spokane, for example, since opening a WTE power plant, the city has increased its recycling rate to 50%,[132] well above the national average of 26%.[133] These additional benefits add up, and may be worth the cost imposed by a $98 per ton tipping fee.[134]

IV. Driving Investment in WTE Through Federal and State Incentives

Given the benefits of WTE facilities and the overwhelming evidence that they are preferable to landfills, the United States must promote investment in new WTE power plants as the solution to its waste management crisis. To accomplish this goal, EPA must revise its waste hierarchy and states must amend their RPS so that WTE facilities are explicitly listed as preferable to landfills with energy recovery. Additionally, Congress should amend EPACT-05 to make the financing

111. A typical plant generates approximately 60 MW. ABB Group, Solutions for Waste-to-Energy-Plants 3 (Feb. 17, 2011), *available at* http://www05.abb.com/global/scot/scot221.nsf/veritydisplay/79146184a95f70c4c125783a00363b8e/$file/Waste-to-Energy-plants_E_final.pdf.
112. *Energy-From-Waste Facility*, Covanta Energy, http://www.covantaenergy.com/facilities/facility-by-location/lee.aspx (last visited Mar. 28, 2013).
113. Humes, *supra* note 4, at 23.
114. The direct impact area of a wind farm is approximately one hectacre per megawatt. Paul Denholm, Maureen Hand, Maddalena Jackson, & Sean Ong, Nat'l Renewable Energy Lab., NREL/TP-6A2-45834, Land-Use Requirements of Modern Wind Power Plants in the United States 10, 12 (Aug. 2009), *available at* http://www.nrel.gov/docs/fy09osti/45834.pdf.
115. Susan Combs, Texas Comptroller of Public Accounts, The Energy Report 2008, at 257–58 (May 6, 2008), *available at* http://www.window.state.tx.us/specialrpt/energy/.
116. Because regional power grids that make up our national system do not easily transfer power, it is impractical to limit power generation to any specific region of the country. For example, solar plants in the Southwest, which transmits over the Texas Interconnect, cannot power homes in the Northeast, falling within the Eastern Interconnect. Lynn M. Fountain, *Johnny-Come-Lately: Practical Considerations of a National RPS*, 42 Conn. L. Rev. 1475, 1482 (July 2010).
117. *See* Combs, *supra* note 115, at 171; David Appleyard, *Economies of Scale Spur Solar's Expansion,* Renewable Energy World (Oct. 18, 2011), http://www.renewableenergyworld.com/rea/news/article/2011/10/from-the-editor-economies-of-scale-spur-solars-emergence.
118. *Waste to Energy Facility*, Spokane Waste to Energy, http://spokanewastetoenergy.com/WastetoEnergy.htm (last visited Mar. 28, 2013).
119. *Id.*
120. A tipping fee is the service price paid to waste management facilities for accepting deliveries of MSW. *What's a "Tip Fee" and Why Is It so Important?,* Envtl. Resource Ctr., http://www.ercsv.org/index.php?option=com_content&view=article&id=600:whats-a-tip-fee-and-why-is-it-so-important&catid=32:hot-off-the-press&Itemid=293 (last visited Nov. 4, 2013). Crawford, *supra* note 35, at 3 (noting that Spokane paid the balance of the project's debt service on Dec. 1, 2011); *Hours of Operation & Fees*, Spokane Regional Solid Waste System, http://www.solidwaste.org/subfc9f.php?id=5186 (noting that the WTE tipping fee is $98 per ton) (last visited Nov. 4, 2013).
121. Crawford, *supra* note 35, at 3.
122. In 2009, the net cost of operations, less the cost of debt, was $9.8 million. Considering the facility burns 720 tons of waste, 365 days a year, the cost of operations equals $37.29 per ton of MSW. *See generally Waste to Energy Facility*, Spokane Waste to Energy, http://spokanewastetoenergy.com/WastetoEnergy.htm (last visited Sept. 23, 2013).
123. U.S. EPA, *Energy Recovery From Waste, supra* note 7.
124. Jeremy K. O'Brien, *The Economic Development Benefits of Waste-to-Energy Facilities*, MSW Mgmt. (Feb. 6, 2012), http://www.mswmanagement.com/MSW/Editorial/The_Economic_Development_Benefits_of_WastetoEnergy_15968.aspx (*citing* R. Van Haaren, N. Themilis, & N. Goldstein, Biocycle, The State of Garbage in America: 17th Nationwide Survey of MSW Management in the U.S. (Oct. 2010)).
125. *See* Rosenthal, *supra* note 45 (noting that New York City's exports its waste to distant landfills for costs significantly more than $65 per ton).
126. The national average is approximately $45 per ton. *See* Edward W. Repa, Nat'l Solid Wastes Mgmt. Ass'n, Municipal Solid Waste Landfill Facts, Fig. 2 (Oct. 2011), *available at* http://www.environmentalistseveryday.org/docs/research-bulletin/Municipal-Solid-Waste-Landfill-Facts.pdf.
127. *Id.*
128. Crawford, *supra* note 35, at 3.
129. WTE that provides home heating is commonplace in Denmark and Germany, and has been accepted by many communities, in part, because of ratepayers reduced heating costs. *See* Rosenthal, *supra* note 45.
130. A number of bond-financed WTE facilities enjoy top ratings from the various investment ratings agencies. Also, news reports about facilities that are struggling financially point to the exception, not the rule. *See generally* Crawford, *supra* note 35, at 1–3.
131. *See generally* Crawford, *supra* note 35, at 2.
132. *See* Crawford, *supra* note 35, at 3; *Hours of Operations & Fees*, *supra* note 120 (noting that recycling is free).
133. Only 26% of the MSW stream was recycled in 2010. U.S. EPA, MSW Generation, Recycling, and Disposal, *supra* note 8, at Table 29.
134. *Hours of Operation & Fees*, *supra* note 120.

of new WTE facilities more practical for municipalities and independent investors.

Part A details how EPA should update the waste hierarchy to promote WTE over landfills and why this action should cause states to consider doing the same. Part B suggests that states revise their existing RPS by making WTE a first-tier renewable energy source. Part C suggests making WTE eligible for PTCs equal to other renewable energy sources. Part D proposes reinstating the DOE section 1705 loan guarantee program. Taken together, these proposals will reduce the high cost of implementing WTE that has forestalled investment in years past and limit the future use of landfills.

A. *Changing the Waste Hierarchy*

EPA must revise its waste hierarchy to place WTE above landfills with energy recovery because WTE is a superior solution for both waste management and renewable energy generation. This step may seem symbolic, but many states take cues from EPA and follow similar hierarchies.[135] Therefore, this proposal will have effects that trickle down to the waste management decisions made at the state and municipal levels.

New York City provides one example where adoption of EPA's hierarchy has had a negative impact on the implementation of WTE. Beginning in the late 1980s New York went through a movement to rid the city of all landfills.[136] Although New York prioritized WTE over landfills (without energy recovery) by statute,[137] this was not the case in practice. Waste reduction and recycling were prioritized over WTE and landfills, and WTE would only be implemented if the cities recycling efforts were first successful.[138] Because the recycling program did not meet its stated goals, use of WTE never came to fruition and the city was forced to export their waste to distant landfills.[139] Had New York City implemented a hierarchy that required the use of WTE over landfills (in *and* out of state) regardless of recycling rates, it would not only have been free from the burden of exporting waste, but it also would have benefitted from increased electricity production from a renewable energy source.

The other problem plaguing New York City was the perception that WTE was a hazardous polluter.[140] This perception is the reason the city has not built any WTE facilities.[141] Widespread dissemination of positive WTE emissions data could play a significant role in making WTE a reality across America. If waste hierarchies were rewritten to reflect this data, public perceptions would likely change.

B. *A Better Renewable Portfolio Standard*

In addition to updating waste hierarchies, states must amend their RPS to make WTE a qualified first-tier renewable energy source. Regardless of any revisions to the waste hierarchy, states may face pressure to amend their RPS as WTE gains a more favorable public perception. Market choices will also influence whether states choose to further incentivize WTE under existing standards. If developers invest in WTE due to increased federal incentives or otherwise, states failing to make WTE Tier I may be forced to import renewable energy from other states, at a higher cost, in order to meet their renewable-consumption goals.[142]

Connecticut and Maryland provide divergent examples of how states have used their RPS' to encourage development in WTE. As previously discussed in Part III.A, Connecticut has long accepted WTE as a superior waste management solution to landfills.[143] Recently, however, failure to amend the state's RPS to reflect this preference has hindered the financial performance of the state's existing WTE power plants.[144] In support of reclassifying WTE as Tier I renewable energy source, the Mayor of Hartford argued that a reclassification would stabilize tipping fees and make electricity rates more predictable for ratepayers.[145] Unfortunately, a bill amending the state's RPS has yet to pass and Connecticut may be forced to import renewable energy to meet its RPS goals.[146] Unlike Connecticut, Maryland has recently amended its RPS to make WTE a Tier I renewable energy source.[147] As a result of this legislation, it is anticipated that electricity generation from WTE will more than double over the next decade.[148]

As supported by the example above, when a state promotes WTE to Tier I status, new development will likely follow.

135. *See, e.g.,* Allaway & Spendelow, *supra* note 69; *Local Solid Waste Management Planning,* N.Y. Dept. of Envtl. Conservation, http://www.dec.ny.gov/chemical/47861.html (last visited Apr. 7, 2013); Dep't of Energy & Envtl. Prot, *Solid Waste Management in Connecticut,* State of Conn., http://www.ct.gov/deep/cwp/view.asp?a=2718&q=325464&deepNav_GID=1646%20 (last updated June 12, 2013).

136. Behnke, *supra* note 15, at 112 (noting that New York DEC issued its plan in 1987 to close 258 of the state's municipal landfills by 1997, leaving only 100).

137. *Local Solid Waste Management Planning (LSWMP),* N.Y. Dep't of Env't Conservation, http://www.dec.ny.gov/chemical/47861.html (last visited Apr. 7, 2013), *citing* New York State Environmental Conservation Law 27-0106.1 (noting that the top solid waste management priority is to reduce the amount of solid waste generated; then second, to reuse material for the purpose for which it was originally intended or to recycle material that cannot be reused; third, to recover, in an environmentally acceptable manner, energy from solid waste that can not be economically and technically reused or recycled; and fourth, to dispose of solid waste that is not being reused, recycled or from which energy is not being recovered, by land burial or other methods approved by the department).

138. Behnke, *supra* note 15 at 108, 112, 116.

139. *Id.*

140. *Id.* at 108.

141. *Id.* at 140.

142. In Connecticut, where WTE is already commonplace despite a lack of federal incentives, the choice to designate WTE Tier II has forced the state to look to its neighbors for qualifying renewable energy. *An Act Concerning the Reclassification of Trash to Energy Facilities as Class One Renewable Energy Sources: Hearing on H.B. 5118 Before the H. Comm. on the Environment,* 2012 Leg. Sess. (Conn. 2012) (testimony of Mayor Pedro E. Segarra, City of Hartford).

143. Conn. Dept. of Energy & Envtl. Prot., *supra* note 97.

144. *An Act Concerning the Reclassification of Trash to Energy Facilities, supra* note 142.

145. *Id.*

146. *Id.*

147. Pub. Serv. Comm'n of Md., Renewable Energy Portfolio Standard Report of 2012, at 4 (Apr. 2012), *available at* http://webapp.psc.state.md.us/intranet/Reports/2012%20Renewable%20Energy%20Portfolio%20Standard%20Report.pdf.

148. There was no change in total capacity between 2007 and 2013. Total capacity, however, is expected to increase from 128–287 MW between now and 2022. *See* Md. Office of the Governor, Maryland's Greenhouse Gas Reduction Plan: Renewable Energy 9, *available at* http://governor.maryland.gov/documents/GGRAslides.pdf (last visited Sept. 23, 2013).

However, when WTE remains Tier II, states may be forced to import renewable energy at the expense of their existing power plants. For these reasons, states must amend their RPS to encourage the development of new WTE facilities.

C. Amending EPACT-05 to Increase the PTC

1. The Language of the Bill

Congress should amend EPACT-05 to make WTE eligible for PTCs equal to those available for new wind and photovoltaic energy projects. Congress should also amend EPACT-05 to extend the expiration of the PTC incentive. The amendment to Title 26 United States Code should read as follows:

> **Section 1. Renewable Energy Production Tax Credit**
>
> (a) In General.—Subsection (a)(4)(A) of Section 45 shall be amended by striking the existing language and replacing it with the following:
>
> "(A) Credit Rate. There will be considered two tiers of qualified facilities for the purposes of this tax credit.—
>
> "(i) The first tier is eligible to receive the full value of the tax credit, and includes: qualified wind, geothermal, closed- and open-loop biomass, certain municipal solid waste, and small irrigation power facilities as described in subsection (d).—
>
> "(I) Waste to energy or trash facilities, as described in subsection (d), shall be qualified first tier.—
>
> "(ii) The second tier may not receive more than half of the full value of the production tax credits.—
>
> "(I) The second tier consists of the qualified facilities described in subsection (d) but not listed above in subsection (a)(4)(A)(i).—
>
> "(II) Landfills with energy recovery shall be deemed second tier facilities for the purposes of this tax credit.—
>
> These provisions will mitigate the challenges posed to financing a WTE facility and should encourage the development of new plants.
>
> The goal of increased WTE utilization and reduced reliance on landfills should not be limited in time. Therefore, Congress should also extend the period of time for which new WTE facilities are eligible to receive the benefits of PTCs. The second section of the PTC amendment should read as follows:
>
> **Section 2. Expiration**
>
> (b) In General.—Subsection (d)(7) of Section 45 by striking the existing language and replacing it with the following:
>
> "(7) In the case of a facility (other than landfill gas recovery) which uses municipal solid waste to produce electricity, the term "qualified facility" means any facility owned by the taxpayer which is originally placed in service after the date of the enactment of this paragraph and the construction of which begins before any year, in which any preceding year (since the year of enactment) saw more than ten percent of the United States' MSW discarded in landfills. A qualified facility includes a new unit placed in service in connection with a facility placed in service on or before the date of the enactment of this paragraph, but only to the extent of the increased amount of electricity produced at the facility by reason of such new unit.
>
> Provided that Congress adopts these amendments, development in WTE should increase until the point where the majority of our MSW is processed by incineration (or recycled) as opposed to being dumped in landfills.

2. PTCs Are a Proven Success

Growth in the wind power sector provides the strongest evidence that PTCs are effective. From 2005–2012, energy production from wind farms in the United States has grown on average 16% annually.[149] This annual growth rate amounts to a 667% increase in total supply over the past decade.[150] A driving force behind this rapid development is the 2.3¢ PTC.[151] In the last decade, the tax credit has been scheduled to lapse numerous times.[152] When expiration approaches, developers suggest that they will stop investing in wind power if Congress fails to grant an extension.[153] Holding up their end of the bargain, the wind industry has staggered when the PTC has been allowed to sunset.[154] But after investment dips, Congress has reauthorized the provision and the industry has boomed.[155] In 2012, wind power became the top source of new generation after developers rushed to get projects online before the expiration scheduled in December of that year.[156]

3. An Increased Incentive Will Spur Development

WTE has not experienced the same highs associated with reauthorizations of the PTC. Ignoring the political opposition to WTE, the simplest explanation for the lack of new development is the cost.[157] A large facility may require up to $350 million in capital and incur $28 million in annual

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149. In 2005 domestic wind farms supplied 0.178 quadrillion BTU as compared to 1.366 BTU in 2012. U.S Energy Info. Admin., Short Term Energy Outlook (Mar. 2013), *available at* http://www.eia.gov/forecasts/steo/report/renew_co2.cfm.
150. *See id.*
151. Internal Revenue Service, Credit for Renewable Electricity Production, Refined Coal Production, and Indian Coal Production, and Publication of Inflation Adjustment Factors and Reference Prices for Calendar Year 2013, 78 Fed. Reg. 20176, 20177 (April 3, 2013).
152. *See Production Tax Credit for Renewable Energy,* Union of Concerned Scientists (last revised Jan. 4, 2013) http://www.ucsusa.org/clean_energy/smart-energy-solutions/increase-renewables/production-tax-credit-for.html.
153. *Legislative Affairs: Production Tax Credit Extension,* Am. Wind Energy Ass'n, http:// www.awea.org/legislative/ (last visited Jan. 4, 2014).
154. *Production Tax Credit for Renewable Energy*, *supra* note 152.
155. Congress has authorized the extension of the PTC five times since 1992. *Id.*
156. Nick Juliano, *Wind: Industry Installed More Generation From Wind Last Year Than Any Other Power Source,* E&E Reporter (Jan. 31, 2013), http://www.eenews.net/EEDaily/2013/01/31/10. The PTC was reauthorized in 2013, but has yet to be reauthorized for 2014. Andrew Restuccia, *Wind Tax Credit Could Take a Big Hit in Tax Battle,* Politico (Nov. 4, 2013), http://www.politico.com/story/2013/11/wind-power-tax-credit-99273.html.
157. Combs, *supra* note 115, at 260.

operating expenses.[158] Much of this cost can be recovered with revenue coming from both tipping fees and electricity generation.[159] To fill the gap, however, further government incentives are necessary.[160] The meaningful impact of PTCs for most developers does not come at the point of sale to the utilities, but when the facility is first developed.[161] Project developers monetize PTCs by selling their future rights to the tax benefit, thereby providing another stream of financing for the upfront cost of building the power plant.[162]

Given the differences between the operation of a WTE facility and a wind farm, it is reasonable to ask whether increasing the PTC for WTE to 2.3¢ will have the same effect on the financing of new projects. The best metric to compare the relative price of energy production from different sources is a levelized cost, which accounts for factors such as the useful life of an operation, generating capacity, installed capital costs, and annual operating expense.[163] Using this metric, on-shore wind costs approximately 7¢ per kWh.[164] Considering that the PTC for wind is 2.3¢ per kWh,[165] it should be obvious why this incentive has a significant impact. The levelized cost of WTE will vary depending on the size of the power plant, but 7¢ per kWh falls within the price range for a typical facility.[166] The specific factors that determine the actual cost will be different for each local government, but given that the cost of the two technologies is in the same range, the impact of giving twice as many PTCs to one technology over another will certainly influence investment decisions.

If the PTC for WTE increases from 1.1¢ per kWh[167] to 2.3¢ per kWh, new investment is likely to follow. An expiration tied to development goals will mitigate the volatility in development—like that seen with wind projects—because investors will be able to better forecast when the expiration expires, as compared to guessing whether Congress will or will not grant an extension. By tying the expiration to the percentage of MSW sent to landfills, new WTE facilities will ultimately replace landfills as the cornerstone of waste management.

D. *Reviving DOE Loan Guarantees*

1. The Amendment Reviving Loan Guarantees

Congress should also amend EPACT-05 to revive DOE's 1705 loan guarantee program and extend the opportunity for WTE to compete on an equal basis with other qualifying technologies. Like the PTC amendment, this incentive should not have a predetermined expiration. The amendment to Title 26 of the United States Code should read as follows:

> **Section 3. Loan Guarantees**
>
> (a) In General.—Subsection (a)(1) of Section 16516 shall be amended by adding the following:
>
> "(A) Expiration. Notwithstanding the September 2011 expiration of this program, new construction for qualified waste to energy facilities, as described in Section 45(d), remain eligible to receive loan guarantees until the U.S. Energy Information Administration determines that less than ten percent of MSW was sent to landfills in any preceding year (following the enactment of this provision).

Loan guarantees have been described as "one of the financial engines powering clean energy investments across the United States."[168] PTCs will make financing and operating a WTE facility more competitive, but loan guarantees are the surest way to raise capital.

2. Why Loan Guarantee Are Necessary

Loan guarantees make financing easier because financial institutions are more willing to lend with the assurance of being backed by "creditor of last resort, the United States government."[169] PTCs, on the other hand, do not give an investor the same security. PTCs are most meaningful if they can be monetized at the time of financing a project.[170] For this reason, the developer is subject to market demand. Large projects that generate a significant number of PTCs may have difficulty finding a single investor due to the risk associated with a lack of diversification.[171] Additionally, if a project is controversial and therefore subject to delays, an investor may consider PTCs too speculative.[172]

Implementing WTE should not be a controversial decision, but given the misconceptions surrounding WTE, proposed plants may face stiff opposition.[173] For this reason, loan guarantees will be necessary in at least some instances.

158. *Id.*
159. Tipping fees and electric generation may earn revenues of $30 and $65 per ton, respectively. *Id.*
160. *Id.*
161. Sony Ben-Moshe et al., *Financing the Nuclear renaissance: The Benefits and Potential Pitfalls of Federal & State Government Subsidies and the Future of Nuclear Power in California*, 30 Energy L.J. 497, 516–17 (2009).
162. *Id.*
163. S. Tegen et al., National Renewable Energy Laboratory, NREL/TP-5000-52920, 2010 Cost of Wind Energy Review iv-v (Apr. 2012), *available at* http://www.nrel.gov/docs/fy12osti/52920.pdf.
164. *Id.* at v.
165. Internal Revenue Service, Credit for Renewable Electricity Production, Refined Coal Production, and Indian Coal Production, and Publication of Inflation Adjustment Factors and Reference Prices for Calendar Year 2013, 78 Fed. Reg. 20176, 20177 (Apr. 3, 2013).
166. *See* Jerry Davis, Nat'l Renewable Energy Lab., Waste-to-Energy Technologies and Applications 7 (May 10, 2011) (costs for large gasification plants range from 6¢–20¢ per kWh), *available at* http://e2s2.ndia.org/schedule/Documents/Abstracts/Davis.pdf.
167. Internal Revenue Service, *supra* note 151, at 20177.
168. Daniel K. Tracey, *The Missing Lending Link: Why a Federal Loan Guarantee Program Is Critical to the Continued Growth of the Solar Power Industry,* 16 N.C. Banking Inst. 349, 350 (2012) (internal quotations omitted).
169. *Cf.* Seth P. Cox, *The Nuclear Option: Promotion of Advanced Nuclear Generation as a Matter of Public Policy,* 5 Appalachian Nat. Resources L.J. 25, 56 (2011) (discussed in the context of new nuclear development).
170. *See* Ben-Moshe et al., *supra* note 161, at 516–17.
171. *Id.* at 515.
172. *Cf. id.* (noting that PTCs are inappropriate for nuclear energy because of a projects inherent risk).
173. In 2012 Baltimore citizens attempted to prevent a developer from finishing a new WTE facility because they believed it would "start[ ] spewing ash, particulates, [and] heavy metals" all across the surrounding neighborhoods. Shen, *supra* note 24.

Despite these risks, DOE loan guarantees have been wildly successful.[174] In the context of solar development, four of the five largest solar farms would not exist without the support of 1705 loan guarantees.[175]

Though loan guarantees have proven successful in many instances, the reauthorization of 1705 loan guarantees will be an uphill battle. Prior to the expiration of the program, the House of Representatives passed a bill seeking to limit loan guarantees in the wake of the highly publicized bankruptcy of loan recipient Solyndra.[176] This bankruptcy, however, does not discredit the program's success. Out of $16.1 billion committed to new projects, loan recipients only defaulted on $300–$400 million.[177] This equates to approximately 2% of the total guarantees. Like commercial lenders, the government budgeted for anticipated defaults.[178] With a $2.47 billion loan guarantee reserve, a $300 million default leaves 85% of the reserve intact.[179]

Like an investment portfolio, a basket of loan guarantees cannot be judged on the success of any individual outcome, but must be gauged on the performance of the portfolio as a whole.[180] Before it expired, DOE's 1705 program was responsible for kick-starting enough clean energy projects to bring electricity to more than 2.5 million homes.[181] Significantly, the program was also directly responsible for creating American jobs and indirectly responsible for "slowing severe job loss" during the economic recession.[182]

For the reasons stated above, loan guarantees should be seen as a resounding success that could be repeated with WTE. As previously noted with respect to PTCs,[183] tying the expiration of eligibility for loan guarantees to the percentage of MSW sent to landfills will ultimately lead to WTE becoming a cornerstone of waste management.

V. Addressing the Counter Arguments

Benefits aside, WTE power plants do have some drawbacks. As such, it is important to address the arguments against WTE in greater detail.

A. Environmental Impact and Life-Cycle Emissions

While accepting that landfills are hazardous, proponents of the *status quo* may argue that communities should not adopt WTE because its environmental impacts are worse than the alternatives. This contention is false as it fails to consider the life-cycle impacts of both energy generation and waste management. As previously discussed,[184] WTE is better than the alternatives for the following reasons: (1) one ton of greenhouse gas emissions are avoided for every ton of MSW processed by WTE as opposed to being dumped in a landfill;[185] (2) high-efficiency filtration systems have reduced dioxin emissions by greater than 99%;[186] and (3) three million pounds of greenhouse gas emissions are avoided for every kilowatt-hour of electricity generated by burning MSW as opposed to fossil fuels.[187]

Another way to consider the life-cycle impact of energy generation and waste management is by using EPA's MSW–Decision Support Tool ("MSW-DST").[188] This software considers long-term impacts on (1) resource consumption, (2) environmental emissions, and (3) cost so that communities can consider the full impact of its waste management decisions.[189]

Using the MSW-DST, a 2007 study considered waste management options for a medium-sized community with a population of 750,000.[190] The results showed that WTE had the least negative environmental impact out of the likely waste management scenarios under consideration.[191] The results concerning carbon-equivalent emissions are the most compelling. Out of ten scenarios considered,[192] the scenario using 70% WTE and 30% percent recycling resulted in the least environmental impact.[193] In this scenario, life-cycle emissions of greenhouse gases were actually negative due to the avoidance of the production of 30,000 tons of CO_2 equivalents.[194] In contrast, the scenario using 70% landfills and 30% recycling resulted in 30,000 tons of greenhouse gas emissions, a 60,000-ton variance from WTE.[195] The results of this study indicate that WTE is far better for the environment than the use of landfills, even those with energy recovery.[196]

174. Tracey, *supra* note 168, at 364.
175. *Id.*
176. No More Solyndras Act, H.R. 6213, Rep. Upton (R-Mich.) (passed by the House on Sept. 14, 2012); *see also* Ashley Southall, *House Passes Solyndra Act Aimed at Obama,* N.Y. Times (Sept. 14, 2012), http://thecaucus.blogs.nytimes.com/2012/09/14/house-passes-solyndra-act-aimed-at-obama/.
177. *Hearing Before the H. Comm. on Oversight and Gov't Reform,* 112th Cong. 146, 19–20 (2012) (statement of Gregory H. Kats, President, Capital E).
178. *Id.* at 20.
179. *Id.*
180. *Id.* at 22.
181. *Id.* at 21.
182. *Id.* at 27.
183. *See supra* note Part IV.C.
184. *See supra* Part I.B & I.C
185. *See* Michaels, Waste Not, Want Not, *supra* note 21.
186. U.S. EPA, Memorandum, *supra* note 42.
187. Michaels, Waste Not, Want Not, *supra* note 21.
188. The Municipal Solid Waste—Decision Support Tool ("MSW-DST") identifies "materials/waste management strategies that balance resource consumption, environmental burdens, and cost." Thorneloe, *supra* note 61, at 1007.
189. The use of full cost accounting and life-cycle inventory can offer the best guidance as to what are the true advantages or disadvantages of a particular waste management solution. *Id.* at 1006.
190. *Id.* at 1009.
191. *Id.* at 1019. Key assumptions included: (1) population of 750,000; (2) waste generation of 3.5 lbs per person per day; (3) use of WTE offset by decrease in the combustion of baseload coal; (4) use of landfill gas recovery offset by decrease in fuel oil or baseload coal depending on whether the gas is piped to a boiler or combusted on site; (5) once a week waste collection; (6) local landfill, compost, WTE, transfer, or MRF facilities located approximately 10 miles from collection; and (7) transport to out of state landfills cover approximately 500 miles. *Id.* at 1009, 1011–12, 1014.
192. The scenarios include a different mix of recycling, local landfills, exported waste, landfill gas recovery, and WTE *Id.* at 1010–12.
193. *Id.* at 1019.
194. *See id.* at 1014, Fig. 9, 1019.
195. *Id.* at 1014, Fig. 9.
196. The scenario using landfill gas recovery for the purpose of energy generation also resulted in positive life-cycle greenhouse gas emissions. *Id.* 1014, Fig 9., 1018–19.

B. Recycling Compatibility

Critics of WTE may also posit that WTE is not compatible with recycling.[197] These critics rely on statistics noting that over 90% of materials burned or buried can be reused, recycled, or composted.[198] However, this statistic is fatally flawed. As shown by the 2007 MSW-DST study, a typical town may find that recycling is not economical at rates greater than 30%.[199] As New York City experienced during its fiscal crisis, where the recycling goal was set at 25%,[200] the market for recycled goods dried up as supply continued to increase.[201] Most compelling, average recycling rates are higher in communities that use WTE.[202] For this reason, the contention that WTE is not compatible with recycling does not hold water.

C. Upgrading Landfills to Recovery Energy

Because WTE plants are expensive, critics may instead suggest upgrading existing landfills to recover gas emissions for energy purposes. Although this suggestion is better than doing nothing, it is not the best solution. Landfill gas recovery is inefficient—as much as 40% of the methane created by landfills escapes into the atmosphere.[203] In the long run, WTE provides returns more energy and profit for every ton of MSW. The average WTE facility will generate 550 kWh of electricity and up to $30 in revenue per ton of MSW,[204] whereas landfill gas recovery generates no more than 84 kWh and less than $9 in revenue per ton of MSW.[205] Therefore, from the same waste stream a community may either update an existing landfill to recover a nominal amount of its potential energy, or raise the capital to implement WTE and make up the cost by producing up to thirteen times as much energy.

D. Indefinite Expiration of the Incentive

Finally, critics may argue that it is unrealistic to limit landfill usage to less than 10% of the MSW stream. As demonstrated by Connecticut, however, this is not the case. In 2008, the state relied on landfills for approximately 11% of its MSW disposal.[206] Likewise, a number of European countries have relied on WTE coupled with the promotion of recycling to reduce their use of landfills.[207] Currently, Germany, the Netherlands, Sweden, Belgium, and Denmark all send at least 30% of their MSW to WTE facilities, and use landfills at rates less than 10%.[208] Because it is possible to avoid harms of landfills altogether, tying the WTE incentives to a reduction in their use is the appropriate way to ensure that WTE facilities replaces landfills as the cornerstone of waste management.

VI. Conclusion

Consumption and the waste it creates is a concern that should be at the forefront of every American's mind. Each year the United States generates waste at alarming rates, a majority of which winds up buried in the ground and results in eyesores like the Fresh Kills landfill, visible even from space.[209] Such mountains of waste do more than harm the environment: they lock away valuable resources, which could otherwise provide renewable energy. With both an ongoing waste crisis and a growing energy deficit, the United States cannot afford to continue throwing away our future.

WTE presents the best solution for the United States growing waste management crisis. Aside from producing baseload energy, WTE mitigates greenhouse gas emissions from both landfill usage and the combustion of fossil fuels for energy production. Negative public perception and prohibitively high capital costs have hampered new WTE development. This should not be the case—public perception surrounding WTE has been misinformed and the cost of constructing new plants can be mitigated with federal and state action.

For the foregoing reasons, the following actions should be taken: (1) the EPA must revise its waste hierarchy to promote WTE above the use of landfills with energy recovery, (2) states must promote WTE to first-tier status under their existing RPS, and (3) Congress must increase the PTC incentive for WTE and reauthorize the 1705 DOE Loan Guarantee Program. If these actions are taken, we may no longer have the problem of figuring out where to haul our waste.

With WTE, our waste legacy will change from burying two homes' worth of garbage per person to providing the fuel that generates the electricity used in our daily lives. Ultimately, waste reduction may be the final goal, but for the foreseeable future, the production of waste will continue at historic rates. WTE can replace landfills, reduce greenhouse gas emissions, generate base load electricity, and stimulate local economies. To ensure a brighter future, where waste is not put to waste, WTE power plants must become the cornerstone of an improved waste management paradigm.

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197. Tan, GAIA, *supra* note 25.
198. *Id.*
199. *See* Thorneloe, *supra* note 61, at 1013.
200. Behnke, *supra* note 15, at 122, 127–28
201. *Id.* at 124–25.
202. Michaels, Waste Not, Want Not, *supra* note 21, at 7.
203. *See* Landfill Gas Basics, *supra* note 56, at 1–8.
204. U.S. EPA, *MSW Basic Information, supra* note 26.
205. P. Ozge Kaplan, Joseph Decarolis, & Susan Thorneloe, *Is It Better to Burn or Bury Waste for Clean Electricity Generation?,* 43 Envtl. Sci. & Tech. 1711, 1716 (2009). Electricity generated by landfill gas can earn between $0.06–$0.11 per kWh. Rachel Goldstein, U.S. Envtl. Prot. Agency, An Overview of Landfill Gas Energy in the United States, slide 11 (Apr. 2009).
206. Ted Michaels, *supra* note 33.
207. *Id.* at 7.
208. *Id.*
209. Humes, *supra* note 4, at 11–12.