Evaluating Subsidies for Landfill Gas to Energy Programs

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National Recycling Coalition

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1. Background

Municipal solid waste landfills, because they contain large amounts of organic matter, generate methane gas as the organic fraction begins to decompose. After a short aerobic phase of decomposition, anaerobic decomposition dominates for much of the methane generation period. Fugitive methane releases from landfills were estimated to comprise more than 3.5 percent of all gross greenhouse gas emissions in the United States during 1998, constituting the single largest source of methane.[1] Because this value assumes high methane capture rates in landfills with existing recovery equipment, actual landfill releases could be much higher.

There is general agreement that curbing these releases makes good environmental sense, and that recovering the energy value would be a much better use of the resource than flaring. However, there is some concern that subsidies to landfill methane recovery can undermine the economic viability of recycling. By reducing the costs of owning and operating a landfill, subsidies to landfill gas to energy projects have the unintended effect of making materials diversion less economically attractive. This concern is especially valid at landfills that continue to accept waste from the surrounding community. However, even for closed landfills, to the extent that the subsidies reduce costs for large, private entities that own multiple landfills, incentives to divert waste streams (including both recycling and source separation of organics) can be diluted.

A related issue involves whether the subsidies are actually needed to encourage methane collection and reuse. More stringent regulation of air emissions from landfills has been implemented over the past five years. This reduces the marginal cost of energy recovery, since many landfills had to install methane collection equipment anyway. Any controls or fees associated with control of greenhouse gases would reduce such costs further. Second, rising values for landfill gas, due to the large increases in natural gas prices, increases the financial

[1] "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 - 1998," (April 2000) EPA 236-R-00-001. Obtained from http://www.epa.gov/globalwarming/publications/emissions/us2000/index.html on 10/20/00.

value of recovering the energy. Finally, technical improvements in the fuel cell and microturbine arena both help to reduce the cost of converting landfill gas to electricity. Although we were unable to evaluate these factors in detail, all suggest that landfill gas to energy activities in many locations is becoming increasingly attractive even without the subsidies.

This paper provides an overview of a number of important government interventions affecting the economics of landfill gas recovery. At the federal level, this includes existing and proposed tax credits/allowances, as well as regulation under the Clean Air Act. At the state level, we examine green power programs, which pay a premium for certain forms of energy, including landfill gas. Our analysis (summarized in Exhibit 3) suggests that these subsidies are significant. On a per-ton basis, they approach $1 to $2 nationally. Landfills able to benefit from green portfolio standards as well can achieve subsidy rates that potentially exceed $5 per ton.

In the aggregate, the tax credits proposed under numerous pending bills are likely to provide subsidies worth hundreds of millions of dollars per year, even if "uptake" (the number of facilities that choose to install methane capture and conversion equipment) is lower than we assumed in our calculations. Since the benefits continue to flow for multiple years, provisions under consideration by Congress now would generate a windfall of more than $3 billion dollars (on a present value basis) to landfill owners over the next ten years. Again, even with far fewer facilities taking advantage of the tax credits than assumed in our analysis, subsidies would be substantial.

2. Existing Law

There are three main government programs that affect the economics of landfill gas to energy programs. These include the Renewable Energy Production Incentive Payments (REPI), the Section 29 tax credit, and the Clean Air Act.

Renewable Energy Production Incentive Payments

Enacted in the Energy Policy Act of 1992, REPI provides payments of up to 1.5 cents per kWh (adjusted for inflation from 1993$) for the first ten years of operations to eligible energy facilities. Landfill gas to energy plants are eligible for payments so long as they are municipally- or cooperatively-owned. According to staff from the Department of Energy, landfills cannot obtain both Section 45 credits (see below) and REPI credits simultaneously. (Mansueti, personal communication, 5/30/01).

Although the payments roughly match subsidies enacted in the tax code for other forms of alternative energy (e.g., wind and solar), a number of drawbacks to the REPI program have made it of limited value to landfill owners. First of all, REPI payments are limited by the funds actually appropriate by Congress each year. If Congress appropriates less money to REPI than there are eligible projects, these projects will receive less (sometimes far less) compensation than they had anticipated. As a result, when up-front investments are made into new systems, the landfill owners can't count on subsidy payments materializing. Furthermore, because plants can receive payments for 10 years, each year of funding will have a larger pool of facilities eligible

for the REPI subsidy. Unless appropriations are increased accordingly, this growing baseline of projects will reduce the likelihood of receiving full funding as time goes on.

Exhibit 1
Overview of REPI Payment History

Pymnt Yr.*	$ to LGTE	Tot. REPI	LG/total	Prod. Yr.	Tot. kWh	Avg. Pymt., all Sources	
	$000s	$000s				cents/kWh	As % of target
1995	593	693	85.5%	1994	42,255,235	1.64	109%
1996	2,178	2,399	90.8%	1995	152,609,779	1.57	105%
1997	1,879	2,491	75.4%	1996	176,950,310	1.41	94%
1998	1,213	2,854	42.5%	1997	458,021,775	0.62	42%
1999	1,715	4,000	42.9%	1998	528,899,024	0.76	50%
2000	382	1,500	25.5%	1999	505,857,620	0.30	20%
Average	1,326		60.4%		310,765,624		

*Applied to the production during the prior fiscal year.

Sources
(1) US DOE, Office of Power Technologies, "Renewable Energy Production Incentive," obtained from http://www.eren.doe.gov/power/repi.html on 5/11/01.
(2) US Energy Information Administration, *Renewable Energy 2000: Issues and Trends,"* February 2001, p. 3.

The situation for landfill operators is made less attractive by the fact that landfill-gas-to-energy facilities, while eligible for subsidy, fall in the "second tier" of energy sources that are eligible. All claims by tier 1 sources (solar, wind, geothermal, closed-loop biomass) must be filled in their entirety before any payments are made to tier 2 sources. While payments not made in one year do carry forward for possible payments in future years, there is a good deal of uncertainty regarding the amount and timing of payments.

Historical data underscore many of these issues. Compensation for landfill methane recovery comprised the bulk of payments in the early years of the program, but has dropped considerably over time, perhaps as more tier 1 sources applied for funds. Appropriations for REPI as a percent of claims have also dropped considerably, and payouts in 2000 were well below the rates qualifying facilities were eligible for. This is an artifact of no increase in funding combined with the 10 year eligibility for programs that form an ever larger baseload.

Section 29: Nonconventional fuels production credit

Enacted to encourage the production of energy from "nonconventional sources," the Section 29 credit included landfill gas for much of its existence. Although new plants are no longer eligible to receive tax credits from this provision, may existing facilities benefit from the credit so long as they began operation prior to July 1, 1998. Credits may be earned through the end of 2007. (Florida, 18).

The section 29 tax credit is pegged at $3 per barrel of oil or barrel-oil equivalent, adjusted for inflation. In 2000, it was worth $6.14/bbl or bbl equiv. Under the assumption that alternative energy becomes economic in its own right as the price of fossil fuels rise, the section 29 credit begins to phase out if the price of domestic crude oil exceeds $23.50 per barrel (multiplied by the inflation adjustment factor, totaling $47.03/bbl in 1999).

Landfills are eligible to obtain the section 29 credit because they produce gas from biomass. Originally, the facility had to be placed in service prior to January 1, 1993 in order to be eligible. However, later amendments enabled facilities placed in service prior to 7/1/98, so long as there was a written binding contract as of 1/1/97, to be treated as meeting the 1/1/93 deadline. (JCX-29-01, p. 14).

While only private facilities pay taxes, and therefore obtain value through tax-based landfill subsidies, financial firms have figured out ways to extend at least some of these benefits even to publicly-owned landfills. Under somewhat complicated deals, the public landfill sells the landfill gas-related assets (wells, piping, tanks, meters, rights to gas produced from the system) to private parties, while retaining operational control and long-term liability for the landfill itself. The municipality generally also agrees to purchase the produced power back from the private party, further narrowing the assets that are privately owned in order to capture the tax credits. Because the private entity receives a rebate from the federal government that the public entity could not otherwise receive, the overall costs of methane recovery and conversion are lower under the new arrangement. A portion of the savings is retained by the investment firm that structured the deal, and a portion flows back to the municipality.

Existing Regulatory Environment

Regulations included in the Clean Air Act of 1996 required more landfills (both existing and new) to collect and control LFG. These controls can be either energy recovery or flaring. Many states also have existing rules requiring LFG collection and control. (Thorneloe et al.). The federal rules alone have had been a limited impetus for upgrading landfills. The rule contains cut-offs for facilities with a design capacity of less than 2.5 million cubic meters (2.75 million tons) and emissions of non-methane organic compounds of less than 50 tons per year, below which the landfills are exempt. (EPA, May 2000, p. 2). EPA data suggests that nearly half of the landfills on which they have exemption data are, in fact, exempt from the control requirements. (EPA, landfill database master file, 5/01).

Thus, while the Clean Air Act does not seem a strong impetus for many landfills to begin harvesting their methane emissions for energy, it is part of a larger group of forces including rising energy values, declining scale economies in methane conversion, and pending regulation of greenhouse gas emissions.[2] In combination, these factors could trigger widespread methane recovery independent of new tax subsidies.

[2] Microturbines are an evolving technology for small scale power conversion using somewhat dirty fuels such as landfill methane. EPA is currently working on a case study examining the economics of microturbines in landfills. However, evidence from methane recovery and conversion at wastewater treatment plants suggests that new technologies are making recovery economic at smaller and smaller facilities. (See Steckel, 2001).

3. New Tax Credit Proposals Affecting Landfill Gas

With new facilities no longer eligible for Section 29 credits, a number of recent Congressional initiatives have included language to introduce new tax credits for pending or current landfills to recover methane. We have analyzed two representative bills here; a complete list of pending legislation compiled by the American Bioenergy Association is included as Exhibit 2.

The proposed legislation generally involves modifications either to Section 29 or Section 45 of the tax code. Subsidies to landfill gas recovery have not been a partisan issue: both the Republican and Democratic energy bills have included them, as did proposals from the White House during both the Clinton and Bush administrations. The specific proposals do differ somewhat in terms of the tax credit amounts, dates of service for eligibility, duration of the credits, and eligibility of direct use. However, all would result in increased returns to landfill operators who recover methane.

Section 45 of the tax code currently provides a 1.5 cents/kWh tax credit (escalated for inflation) for producing electricity from certain sources including "closed-loop" biomass. Only crops grown solely for the production of energy meet the definition of closed loop; landfill gas is not eligible. This would be expanded to a host of other biomass sources, including landfill gas, under all of the current proposals. Section 29 modifications would reopen the eligibility period for methane recovery operations.

- **S. 389, Murkowski**. Bill would expand Section 45 credits to include landfill methane for facilities placed in service subsequent to passage of the act, and through July 1, 2011. The tax credit would be 1.5 cents per kWh. Even if not converted to electricity by the taxpayer, landfill gas sold to an independent third party prior to conversion to electricity would be eligible for the per kWh using the assuming that 10,000 Btu of landfill gas equal one kWh of electricity. (Lazzari and S. 389, Sec. 991).

- **S. 596, Bingaman**. Bill would also expand Section 45 credits to include landfill gas, but at a higher base rate of 1.8 cents per kWh. Biomass facilities would be eligible for the credit retroactively. Thus, all existing facilities, and any new ones, would get the tax credit. Co-production of heat and electricity would receive an additional 0.25 cents per kWh tax credit. Public facilities receiving the credits would be free to sell them to private parties. The bill restricts eligible facilities to receiving either a Section 29 or a Section 45 credit in a given tax year (S. 596, p. 77).

- **Bush Administration Proposal**. Although there are few specifics in the administration's energy plan, the general objectives relating to landfill gas are simily to S. 389 and S. 596. Rather than working to expand the Section 45 credit, the Bush Energy Plan discusses an expansion of the Section 29 credit instead. There is discussion of tiering the tax credit, depending on whether a landfill "is already required by federal law to collect and flare its methane emissions due to local air pollution concerns." (Bush Plan, App. 1, Chap. 6). Ostensibly, because the facilities already required to collect methane, they would face lower

incremental costs to recover energy and receive a lower tax credit. Earlier Administration tax proposals addressed landfill gas subsidies using the Section 45 provisions rather than those in Section 29 of the tax codes. They provided some retroactive credits for facilities placed in service prior to January 1, 2002, though only at 60% of the normal rate (1.7 cents/kWh), and only for 3 years (rather than 10 for facilities that enter service after passage). (Treasury, 4/01, 46).

Exhibit 2
Biomass Tax Credit Legislation in 107th Congress & Administration Proposal

Lead Sponsor/Number	Provisions Included	Status/ABA Support
Collins/Boxer (S. 188)	-10-year provision -New and existing open loop	-Introduced 1/25/01 -No co-firing provisions
Reid (S. 249)	-Permanent provision -New and existing open loop	-Introduced 2/6/01 -Incomplete biomass provision; co-firing omitted
Murkowski (S. 389)	-10-year provision -Closed loop extension -New and existing open loop -25% co-firing provision	-Introduced 2/26/01 -ABA does not like co-firing provision in bill.
Bono (H.R. 983)	-Landfill gas provision only	-Introduced 3/13/01 -Incomplete biomass definition
Bingaman (S. 596)	-Permanent provision -Closed loop extension -Closed and open loop co-firing -New and existing open loop	-Introduced 3/22/01 -ABA working so closed loop co-firing gets get full credit
Grassley (S. 756) GREEN Act	-5-year provision -Closed loop extension -New and existing open loop -Closed loop co-firing	-Introduced 4/6/01 -Open loop co-firing left out
Herger (H.R. 1657)	-Companion bill to Grassley	-Introduced 5/1/01
Inslee (pending)	-5-year provision -Closed loop extension -New open loop -Open loop co-firing	-ABA working to include closed loop co-firing
Bush Administration	-3-year provision -Extension of closed loop biomass (excludes poultry litter) -New and existing open loop biomass at 1.5 cents/kWh -Co-firing biomass with coal at .5 cents/kWh	-Early proposal
Source: American Bioenergy Association (ABA), legislative update, obtained from www.biomass.org/alerts/htm on June 25, 2001. Last updated May 8, 2001.		

4. State Level Incentives for Landfill Gas: Green Power Programs

While many states provide tax and other incentives to landfill gas recovery, we were able to evaluate one such incentive systematically: green power programs. Green power initiatives set a state requirement that a certain portion of the state's generating capacity be met through renewable or other power sources considered to be environmentally beneficial. Because landfill gas converts a waste product to energy, it meets the green power standards for most states (the definition of what counts as green power is set locality by locality). Generally, state incentives are additive to the subsidies already flowing at the federal level.

Green power is normally purchased at a premium to conventional power sources, and this premium constitutes a subsidy to landfill gas for being included within the definition of green power. The premium varies widely across states. However, for landfill gas-to-energy, premiums generally range between 1 and 3.4 cents per kWh (see Exhibit A-3 for additional detail). Because many of the programs require competitive bids from green power providers to ensure minimum cost of meeting the green portfolio standards, we would expect the average subsidy to decline over time. In addition, while the subsidies per ton can be quite large, the magnitude of green power procured is quite small. This reduces the distortionary impact of the program on landfills nationally, though local economics could be affected.

5. Valuing the Tax Credits

Assessing the value of the tax credits to the landfill sector is not a straightforward exercise. Credits are earned based on the quantity of landfill gas and/or LFG converted to electricity. We have used empirical data on the methane generation rate per ton of waste in place. Because methane is generated from waste for many years, we have also calculated a present value of the tax breaks over the expected methane generation period. Methane generation may last for decades. However, many of the tax credits allow benefit for only the first 10 years of operation. We have used both a 10-year and a 30-year time span to bound our valuation, and because there is a reasonable likelihood of tax modifications being passed (as are included in some of the existing proposal) enabling existing facilities to continue to receive tax credits well beyond the initial 10-year cap.

Future year tax credits have been discounted to the present assuming a 5 percent real discount rate. This is somewhat high for a real discount rate (the tax credits themselves are indexed for inflation). However, it offsets the gradual physical reduction in methane generation over time somewhat, so seemed a reasonable starting point.

There is also an interaction between federal and state tax subsidies. This is because most state tax returns calculate the state tax liability using the federal adjusted gross income (AGI) value from federal returns. The larger the federal subsidies, the lower the AGI, and the lower the base on which state tax liability is calculated. On average, this interaction has been estimated to add roughly 3 percent to the value of the federal tax credits. (Wahl, 8).

Finally, in estimating the aggregate values, we have relied on data compiled by the US EPA on the number of landfills and the waste currently in place from which methane could be generated. The Agency classifies the facilities based on the methane recovery status as well, ranging from recovery and conversion already occurring, to a large number of facilities on which they have no information on the methane recovery status in place. We have tried to make reasonable assumptions regarding which of these facilities would begin recovering methane over the course of the next few years should a tax credit come into place concurrently with high energy prices and pending controls on greenhouse gas emissions. To the extent that fewer facilities come on line, our upper bound estimates on aggregate subsidy values would be too high. Alternatively, to the extent that methane capture rates could be improved over that achieved historically, aggregate subsidies could actually be higher than what we have estimated.

Exhibit 3 summarizes our subsidy estimates. We have provided values assuming both 10 years and 30 years of subsidization to bound the likely subsidies to be realized. Moving from a 10 year to a 30-year eligibility roughly doubles the present value of the subsidies. Key findings include:

- Federal tax credits under both Section 29 and Section 45 of the tax code provide substantial subsidies to landfill operators. These subsidies benefit both private and public landfills. The present value of the tax credits range from $0.50 to $1.00 per ton of municipal solid waste assuming a 10-year period of eligibility. A 30-year period of eligibility would double the subsidy. Using a lower real discount rate (3 percent rather than 5 percent) would increase the subsidies by approximately 10 percent in the 10-year scenario.

- Aggregate subsidies to landfills reach hundreds of millions of dollars per year, with the present value of the subsidies over the life of the provisions worth billions to the industry. These tax breaks could be a competitive threat and should be monitored carefully by the recycling industry.

- Renewable Energy Production Incentive Payments, while benefiting a handful of municipal landfills, appears to have a minor impact on behavior overall. Declining funding, in combination with rising eligible projects and the second-tier status for LFGTE, has meant payments to municipal landfill operators have been small and uncertain.

- Subsidies through green power programs also appear relatively small on a national level. However, subsidies per kWh (and per ton of MSW) can be among the highest of all the programs we evaluated. Thus, careful observation of existing and new green power initiatives is warranted to be sure that localized impediments to the health of recycling markets are minimized.

It is important to note that our estimates of subsidy magnitude are substantially higher than those prepared by the Joint Committee on Taxation (JCT). For all sources of biomass, of which landfill gas recovery is but a fraction, JCT has estimated the tax breaks to be worth at most $300 million per year. (JCX-31-01). Because JCT does not publish its assumptions it is impossible to know for sure why the values differ. Some likely factors include (a) much less detailed data on the landfill sector from which to generate an estimate; (b) shorter period of eligibility for new

projects and low or no eligibility for existing projects to receive tax credits; (c) assumption that public landfills won't get the tax credits; and (d) fewer facilities installing recovery overall.

Exhibit 3
Summary Estimates, Subsidies to Landfill Gas to Energy Programs (notes 1, 2)

	Section 29 Credit		Section 45 Credit		REPI		Green Power	
	Low	High	Low	High	Low	High	Low	High
1. Annual Value per ton MSW (note 1)								
Federal	$ 0.06	$ 0.07	$ 0.11	$ 0.13	ID	ID	NA	NA
Plus state interactions	$ 0.00	$ 0.00	$ 0.00	$ 0.00	NA	NA	NA	NA
Direct breaks, state & local							$ -	$ 0.24
Total	$ 0.07	$ 0.07	$ 0.11	$ 0.13			$ -	$ 0.24
2. Annual aggregate value (upper bound, $millions) (note 3)								
Federal	$ 164	$ 182	$ 454	$ 545	$<2	$<2	NA	NA
State & Local	$ 5	$ 5	$ 14	$ 16	NA	NA	$<10	$<10
Total	$ 169	$ 188	$ 468	$ 562	$<2	$<2	$<10	$<10
3. Present Value per ton MSW (notes 4, 5)								
10 year eligibility	$0.51	$0.56	$0.84	$1.00	ID	ID	$0.00	$1.84
30 year eligibility	$1.01	$1.12	$1.66	$2.00	ID	ID	$0.00	$3.66
4. Present Value aggregate value during life of provision ($millions)								
10 year eligibility	$ 1,304	$ 1,449	$ 3,614	$ 4,336	ID	ID	ID	ID
30 year eligibility	$ 2,597	$ 2,885	$ 7,194	$ 8,633	ID	ID	ID	ID

Key: NA = not applicable; ID = Insufficient Data

Notes:
(1) See appendix tables for detailed derivation of component subsidies.
(2) Estimates are based on the assumption (confirmed by EPA) that EPA data reflect actual methane captured, rather than methane generated (of which as much as 50 percent can be lost). Should capture rates rise, available methane would also rise, increasing the value of the existing and proposed subsidy programs.
(3) Aggregate values have been derived by multiplying subsidies per unit waste by EPA's existing data on municipal waste in place across the country. Values are sensitive to the timing new methane capture and conversion comes on line, and to the percentage of facilities that decide to install the equipment. The calculations assume that 75 percent of the landfills classified by EPA as having unknown methane recovery status or having a low interest in installing such equipment under past market conditions (relatively low energy prices) would institute methane recovery and conversion with current energy market conditions plus a tax credit. Values assume 100 percent of the facilities with planned, potential, or in-construction recovery equipment will come on line.
(4) While methane generation can continue for 30 years, many of the tax subsidies last for only ten. The actual period of benefit will likely be somewhere in between. There is precedant for legislative amendments to extend the period of eligibility for tax subsidies beyond that orginally authorized. However, the benefits of the extension begin to decline somewhat at methane yields drop off.
(5) Present value calculations assume a real discount rate of 5 percent, which is slightly high and partially incorporates declines in methane yields in later years. Inflation is not a factor for many of the subsidies, since payments/credits are automatically inflated on an annual basis. Use of a 3 percent real discount rate would yield higher lifetime values.

Source: Earth Track, Inc. calculations

6. Summary

Preliminary evaluation of existing and proposed subsidies to landfill gas recovery and conversion programs suggest that recycling is harmed by the programs. While there is little argument that methane should be captured, and that converting this resource into energy makes a great deal of sense on environmental grounds. However, the hundred of millions of dollars per year in subsidies that will flow to landfill operators, many of them large, privately-owned corporations, can cause real harm to materials diversion and recycling. This would be unfortunate, since over the longer-term, improved materials recovery offers even larger environmental benefits than methane recovery today.

Proponents of new subsidies to landfill gas recovery should be required to make their case in much greater detail before the recycling community should support these subsidies. It may be that in light of new technology and much higher values for energy than even one year ago, the vast majority of landfill operators will find methane recovery economic even without public subsidy. Where regulatory drivers, such as the Clean Air Act and pending actions on controlling greenhouse gas emissions are the prime force behind installation of methane recovery and conversion, care is needed to avoid subsidizing environmental controls that are most properly reflected in the cost of service that landfills provide. Specifically, subsidies to small municipal landfills at, or near, closure, may be implementable with little distortion on market behavior. In contrast, subsidies to private landfills, or municipal facilities with many years of operations ahead (or which may be sold to private entities), provide a more direct threat to the economics of materials diversion and recycling.

State and local subsidies to landfill gas were examined only briefly. However, they appear to be growing, and in some cases are quite large. Care should be taken at these levels of government as well to be sure that subsidies are needed to bring the power to market, and that the sometimes very high premiums paid to landfill operators don't further weaken already struggling recycling markets.

Appendix

Data Sheets for Individual Provisions

Exhibit A-1
Section 29 Tax Credit

1. Value for Eligible Facilities				Sources/Notes
$/barrel oil equiv.	$ 6.14			Statutory value, scaled for inflation to value in 2000. (Source (1), p. 8, note 14)
Heat content, mmBtu/bbl.	5.8			Source (2)
Tax credit value, $/mmBtu	$ 1.06			
2. Calculating Value for Landfill Gas		**Low**	**High**	Ranges values due to varying data on methane generation rates.
A. Gas generation assumptions from EPA				
Yield, heat content, mmBtu/yr per ton MSW		0.060	0.067	Source (3)
Yield, electricity, kWh/ton MSW		7.0000		Source (4)
B. Value of Tax Credit per ton of MSW				
Annual Value, federal level only, dollars per ton		$ 0.064	$ 0.071	
C. Annual Aggregate Value				
Existing landfills with operational landfill gas recovery				
Waste in place (mil. tons)		2,582		Source (5)
Upper bound value, Sect. 29 credit, $millions		$ 164.0	$ 182.2	

Sources:

(1) Joseph Mikrut, Tax Legislative Counsel, Department of the Treasury, Testimony before the Subcommittee on Select Revenue Measures, Committee on Ways and Means, May 3, 2001.
(2) SCS Engineers, *Comparative Analysis of Landfill Gas Utilization Technologies* , prepared for Northeast Regional Biomass Program, March 1997, p. 3-45.
(3) US EPA Landfill Methane Outreach Program, "Small Landfills = Uptapped Energy Potential," January 2001. EPA 430-F-01-001.
(4) US EPA Landfill Methane Outreach Program, "Potential Benefits Gains by Landfill Owners/Operators from LFGTE," last updated 4/27/2000. Obtained from http://www.epa.gov/lmop/follow.htm on 5/7/01.
(5) US Environmental Protection Agency, Landfill Methane Outreach Program, Master Landfill Gas Recovery data file, June 2001.

Exhibit A-2
Section 45 Tax Credit

	Low	High	Sources/Notes
1. Value for Eligible Facilities			
Tax credit value, cents/kWh	1.5	1.8	Sources (2, 3, 4). Unclear if lower bound would be adjusted for inflation since 1993 (to 1.7 cents) or not.
kWh/ton of waste	7.00	7.00	Source (1)
2. Calculating Value for Landfill Gas			
A. Annual Value, $/ton MSW	$ 0.105	$ 0.126	
B. Universe of Facilities	Waste-in-place, Mil. tons		
In construction	434.5		
Potential	445.1		
Unknown	906.8		Assumes 75% of landfills with unknown methane recovery could come on line for new tax credits
Planned	2,452.0		
Low Interest	88.7		Assumes 75% of landfills with low current interest in methane recovery
Total	4,327.1		would find it attractive to do with the new subsidy.
C. Annual Aggregate Value of Subsidy to Landfills			Value in early years would be lower as facilities not yet on-line.
Upper bound est., calculated based on WIP	454.3	545.2	Source (5).
Treasury Estimates, based on President's Budget Proposal	$ 221.0	$ 221.0	Includes wide range of biomass sources, not just landfill gas. (Sources 6 and 7). Values based on very short (3-year) window to put new facilities in place.

Sources:

(1) US EPA Landfill Methane Outreach Program, "Potential Benefits Gains by Landfill Owners/Operators from LFGTE," last updated 4/27/2000. Obtained from http://www.epa.gov/lmop/follow.htm on 5/7/01.
(2) S. 389, "National Energy Security Act of 2001," 107th Congress, 1st Session, introduced February 26, 2001.
(3) S. 596, "Energy Security and Tax Incentive Policy Act of 2001," 107th Congress, 1st Session, introduced March 22, 2001.
(4) Lazzari, Salvatore. "IB10054: Energy Tax Policy," CRS Issue Brief for Congress. (Washington, DC: Congressional Research Service, April 9, 2001. Obtained from http://www.cnie.org/nle/eng-60.html on 5/7/01.
(5) US Environmental Protection Agency, Landfill Methane Outreach Program, Master Landfill Gas Recovery data file, June 2001.
(6) US Department of the Treasury, *General Explanations of the Administration's Fiscal Year 2002 Tax Relief Proposals*, April 2001, p. 46.
(7) Joint Committee on Taxation, "Estimated Revenue Effects of the President's Fiscal Year 2002 Budget Proposal, Fiscal Years 2002-2011," May 4, 2001, JCX-31-01.

Exhibit A-3
Overview of Existing Green Power Programs

State	Utility Name	Program Name	Type	Size	Size Unit	Start Date	Premium (cents/kWh)		kWh/ton MSW/yr	Value, cents/year		Value,$, total annual pymts., 85% util.	
							Low	*high*		*Low*	*High*	*Low*	*High*
AL	Huntsville Utilities (TVA)	Green Power	landfill gas +			2000	2.67		7.00	18.69	-	no data	no data
CA	City of Alameda	New Renewables Program	various	TBD	na	1998	1		7.00	7.00	-	no data	no data
CA	City of Palo Alto Utilities	Green Resources	landfill gas +	TBD	na	2000	1.2	3.4	7.00	8.40	23.80	no data	no data
CA	Sacramento Munic. Util. District	Greenergy	landfill gas only	8.3	MW	1997	1		7.00	7.00	-	616,325	-
IA	Alliant Energy	Second Nature	landfill gas +	TBD	na	2000	2		7.00	14.00	-	no data	no data
KY	Bowling Green Municipal Utilities (TVA)	Green power	landfill gas +		na	2000	2.67		7.00	18.69	-	no data	no data
MS	City of Oxford, North East Miss. Elec. Power Assn. (TVA)	Green Power	landfill gas +	TBD	na	2000	2.67		7.00	18.69	-	no data	no data
NE	Omaha Public Power District	TBD	landfill gas only	6.4	MW	2000	TBD		7.00	unk	-	no data	-
OR	Pacific Northwest Generating Cooperative	Green Power	landfill gas only	1.05	MW	1998	1.8	2	7.00	12.60	14.00	140,344	155,938
SC	Santee Cooper	TBD	landfill gas only	2.2	MW	2000	TBD		7.00	unk	-	no data	-
TN	Chattanooga, Gibson Electric, Knoxville, Nashville, Newport, Powell Valley, Servier County (TVA)	Green Power	landfill gas +		na	2000	2.67		7.00	18.69	-	no data	no data
TX	Austin Energy (City of Austin)	Green Choice	landfill gas +	86MW (combined)	na	2000	-0.5		7.00	(3.50)	-	no data	no data
WA	Benton Country Public Utility District	Green Power Program	landfill gas only	1	MW	2000	ontribution		7.00	unk	-	no data	-
WI	Alliant Energy	Second Nature	landfill gas +	TBD	na	2000	2		7.00	14.00	-	no data	no data
WI	Wisconsin Electric Power Company	Energy for Tomorrow	landfill gas +	9.8	MW	1996	2		7.00	14.00	-	1,455,418	-

	Min	*Max*
	-	23.8

Key: TBD = to be determined; na = not available; MW = megawatt

Source: National Renewable Energy Laboratory, "Summary of Green Pricing Programs," last updated on 3/6/01. Obtained from http://www.eren.doe.gov/greenpower/summary.shtml on 5/29/01.

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