Are Clean Air Act Bonus SO_2 Allowances Worth the Hassle?

Philip E. Koebel, Southern California Edison

The Clean Air Act, as amended by Congress in 1990, established a nationwide market for utility SO_2 allowances and set aside 300,000 allowances in a Conservation and Renewable Energy Reserve to go to utilities for demand-side management (DSM) programs or renewable generation. The DSM SO_2 bonuses are awarded at a rate of one allowance for every 500 MWh of verified, actual energy savings from utility DSM installed in or after 1992.

The Southern California Edison Company (Edison) sports one of the largest DSM programs in the United States. Annual savings have been clipping along at 600 to 900 GWh. In 1993, Edison's DSM programs saved 970 GWh.

Since DSM is cumulative and energy efficiency measures persist over time, the DSM installed in 1992 lasts into 1993 and beyond. The DSM in 1993 lasts into 1994 and so on. Very quickly, Edison could be requesting substantial bonuses. By the end of its 1995 program year, Edison would be eligible for 7,500 allowances. By 2000, the number of allowances could be nearly 34,000 or 11.3% of the Reserve.

So, if any utility should be interested in claiming DSM SO_2 bonus allowances, Edison should. Or should it? For various reasons, especially market price projections, the incentive to apply for bonus allowances is small for even the largest utilities with the most expansive DSM programs.

This paper examines the potential value of anticipated allowances to Edison and the impact that they will have on DSM cost-effectiveness.

Introduction

Southern California Edison Company is one of the largest electric utilities in the country. In 1993, it had $7.4 billion dollars in revenue from *73.3* billion kWh in energy sales. In 1992, Edison reached a new peak demand of 18,413 MW. Its more than four million customers are spread over 50,000 square miles from the Nevada border to the Pacific Ocean, north of San Diego to the Sierra Nevada and the middle of the San Joaquin valley.

Like most western utilities, all of Edison's generating units are classified as Phase II units under the Clean Air Act due to their size and emission rates. As such, these units are not required to hold allowances for SO_2 emissions until the year 2000. (Phase I units, mostly found in the eastern United States, must hold allowances for every ton of SO_2 they produce starting in 1995.) Further, because Edison has shifted all of its oil-fired generating units to natural gas in recent years, its allocated allowance beginning in 2000 will be far greater than its need. Thus, Edison will be a surplus allowance provider in the national market.

This status puts Edison into the emissions trading market as a "seller." However, Edison has yet to make a trade. Although expected and actual prices of allowances are converging (Hahn and May 1994), the lack of definitive price information and the inability to finalize sales presents risks that are not yet clearly balanced by rewards. In general, utilities are awaiting regulatory reforms, such as incentive mechanisms that share risks and rewards from allowance trading between shareholders and ratepayers, and more information regarding pricing and direction from the allowance market before selling (Mason 1994).

Edison's tentativeness is echoed throughout the market, even by Phase I utilities. "Utilities and regulators are not taking advantage of the benefits of allowance trading" (Bohi 1994). As yet, there are no established regulatory incentives to trade. However, other compliance options, such as the installation of scrubbers, are supported by favorable cost recovery treatment, for example (Bohi 1994). The total volume of known trades for Phase I allowances is 776,000 (just 2.7%) of the 28.5 million

available, while approximately 2% of Phase II allowances have been traded (Hahn and May 1994).

Added to the infancy of the national market is another complication unique to southern California. This is the local, regional air emissions market, RECLAIM, which was recently established by the South Coast Air Quality Management District (AQMD). Because of the region's chronic noncompliance with federal air quality standards, RECLAIM is designed to cost-effectively reduce air basin emissions of SO_2, NOx, and other pollutants. Although Edison is not subject to RECLAIM's SO_2 provisions, the regional market might affect the national market.

The newness of the national SO_2 market, its price uncertainty, and the complication of the regional-federal market interaction create a fog, through which it is difficult to see the advantage of the DSM bonus SO_2 allowances. The purpose of this paper is to cut through this fog and look at the cold, hard cash question of what these bonuses are worth to a utility with an operating DSM business line. More exactly, what is the value of expected DSM bonus allowances to Edison and its ratepayers and how does that value affect the cost-effectiveness of DSM programs?

Assumptions

To answer these questions, we make the following assumptions:

Persistence of Savings— The lives of DSM measures range from five years for domestic lighting measures (e.g., compact fluorescent bulbs) to more than 20 years for air conditioning and refrigeration equipment. An average weighted by energy savings of the lives of energy efficiency measures installed as a result of Edison's Commercial, Industrial, and Agricultural Energy Efficiency Incentive programs yields 12 to 13 years. For our analysis, we choose a slightly more conservative estimate of 10 years. This means that we assume that all measures installed in 1992 persist for 10 years until 2001. To simplify the analysis, the 10-year persistence assumes neither decay before 10 years nor retention longer than 10 years.

"Actual" Savings— In California, accounting of energy savings is done on an annualized basis. If a measure is installed any time in a DSM program year, the savings from the measure are assumed to have occurred over the whole program year. This assumption aligns benefits (i.e., first-year energy savings and capacity reductions) in the same year as the costs incurred to achieve the benefits. The EPA, however, requires that the savings submitted for DSM bonus allowances be "actual" savings. The accounting of actual savings in a particular year can become quite complicated, however, so Edison simply assumes that one-half of the annualized savings are actual savings. This follows from the assumption that measures are installed uniformly throughout the year.

Customer-Level Savings— Savings from DSM programs are usually recorded at the customer level (i.e., savings experienced by the participating customer). Because of line losses and generation inefficiencies, though, generation-level energy savings from DSM are about 9% greater on Edison's system. For this analysis, we use the lower customer-level savings.

DSM From 1992 to 1999— EPA regulations state that bonus allowances will be allocated for "qualified energy conservation measures.. that are operational on or after January 1, 199[2], and before the date on which any unit owned or operated by the applicant becomes a Phase I unit or a Phase II unit." (Federal Register 1993, p. 3695) Since Edison's units will fall under Phase II on January 1, 2000, DSM programs implemented after 1999 will presumably not be eligible for bonus allowances.

Savings from Resource Programs Only— The EPA does not allow savings from DSM programs that are only informational; the utility must invest dollars towards the installation of the measure. For our analysis, then, we exclude substantial savings due to Edison's nonresidential energy survey program. For 1992, this means that we assume 300 GWh in savings; for 1993 to 1999, we assume about 600 GWh. (See caveat below.)

Discount Rate— For net present value calculations, we assume a discount rate of 10%, which is Edison's marginal cost of capital.

Price Projections— Like any new market, projections of SO_2 allowance prices are multiple and varied. Although there are newer projections (Hahn and May 1994), our analysis assumes a low of $145 per allowance, a medium of $325, and a high price of $460. The $145 price is consistent with prices paid in the 1993 EPA Allowance auction, where the average price was $156.60 for Phase I allowances and $136.19 for Phase II. As allowances can be banked for the future, by the year 2000 there should be little or no difference in the price of Phase I or II allowances (Hahn and May 1994). The $325 and $460 values come from a Bechtel Power Corporation analysis from 1991 (EL&P 1992). Although slightly aged, these projections are not dissimilar to the high end of early private trades and more recent expectations of future prices (Hahn and May 1994).

Cumulative Value Analysis

Of course, to determine the value to Edison and its ratepayers from these allowances, we must first determine how many there will be. To reiterate, 500 MWh of energy savings earns one bonus allowance. Each allowance permits a utility to emit one ton of SO_2. Table 1 shows Edison's projected DSM bonus allowances by program year. The rows indicate how many allowances will be earned for each DSM program year. As discussed above, program savings persist. Thus, bonuses will be earned from the 1992 DSM program from 1992 to 1999 for a sum of 4,500 allowances. See Figure 1. The columns in Table 1 show the annual total of bonuses from the actual savings of that year and the persisting savings of previous years. The columns sum down to the annual total column, which is the amount that Edison is eligible to claim for each year from the EPA. See Figure 2.

Figure 3 shows the net present value of the annual totals at our three market rates. The figure shows the net present value of the 33,900 allowances to range from $3 million to $9 million. The net present value of the allowances is from 0.5% to 1.4% of Edison's 1993 earnings of $637 million. (On a nominal basis, Figure 4 shows the cumulative value by the year 1999 to range from $5 million to $15.6 million.)

Impact on DSM Cost-Effectiveness

One might expect that bonuses will make a difference to DSM cost-effectiveness. Indeed, a 1992 ACEEE Summer Study paper argued that incentives from the Clean Air Act could make the difference between a cost-effective program and a noncost-effective program (Solomon, Kruger, and Morgan 1992). Recently, the EPA reiterated that Clean Air Act incentives in the form of 1) avoided emissions, 2) Conservation and Renewable Energy Reserve bonus allowances, and 3) Reduced Utilization will improve the cost-effectiveness of certain DSM programs. In particular, the EPA says "the bonus allowances from the Conservation and Renewable Energy Reserve increase the attractiveness of demand-side efficiency and renewable energy as SO_2 compliance strategies" (EPA 1994).

Avoided emissions are merely those emissions not produced by a power plant because of scrubbers, fuel switching, or, in our case, reduced demand. In Edison's case, the value of these avoided emissions is already included in marginal costs of supply avoided by DSM. (Perhaps more interesting is that Edison's marginal SO_2 emission rate is less than one pound per megawatt-hour. Because each bonus earned at 500 MWh allows for the emission of one ton of SO_2—four pounds per MWh-more SO_2 is "allowed" to be emitted than avoided.)

Table 1. Edison's Projected DSM Bonus Allowances

	Bonus Allowances Earned Annually								
Program Year	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**PY Total**
1992	300	600	600	600	600	600	600	600	4,500
1993	0	600	1,200	1,200	1,200	1,200	1,200	1,200	7,800
1994	0	0	600	1,200	1,200	1,200	1,200	1,200	6,600
1995	0	0	0	600	1,200	1,200	1,200	1,200	5,400
1996	0	0	0	0	600	1,200	1,200	1,200	4,200
1997	0	0	0	0	0	600	1,200	1,200	3,000
1998	0	0	0	0	0	0	600	1,200	1,800
1999	0	0	0	0	0	0	0	600	600
Annual Total	300	1,200	2,400	3,600	4,800	6,000	7,200	8,400	
Cumulative Total	300	1,500	3,900	7,500	12,300	18,300	25,500	33,900	33,900

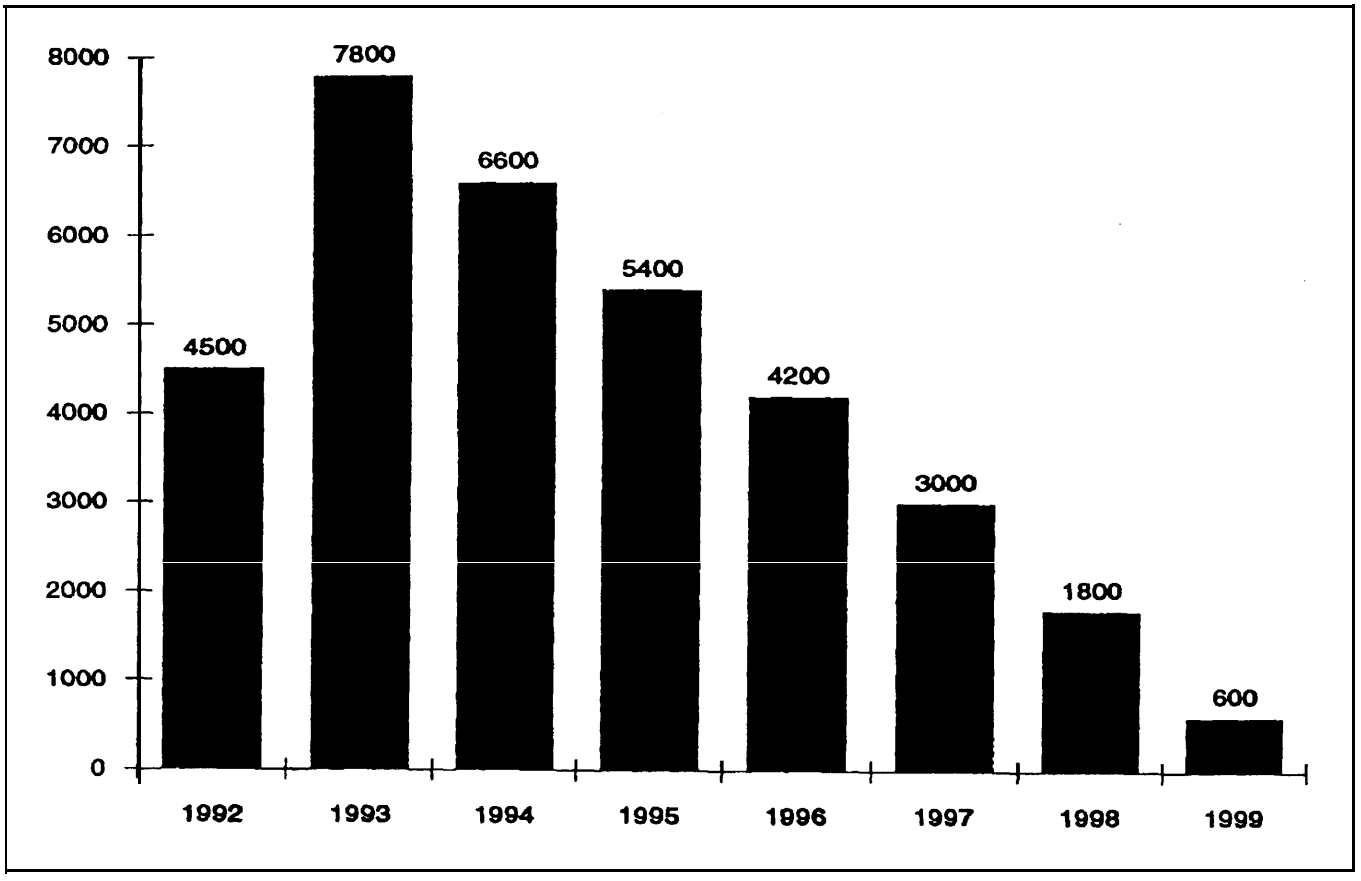

Figure 1. DSM Bonus Allowances Earned by Program Year

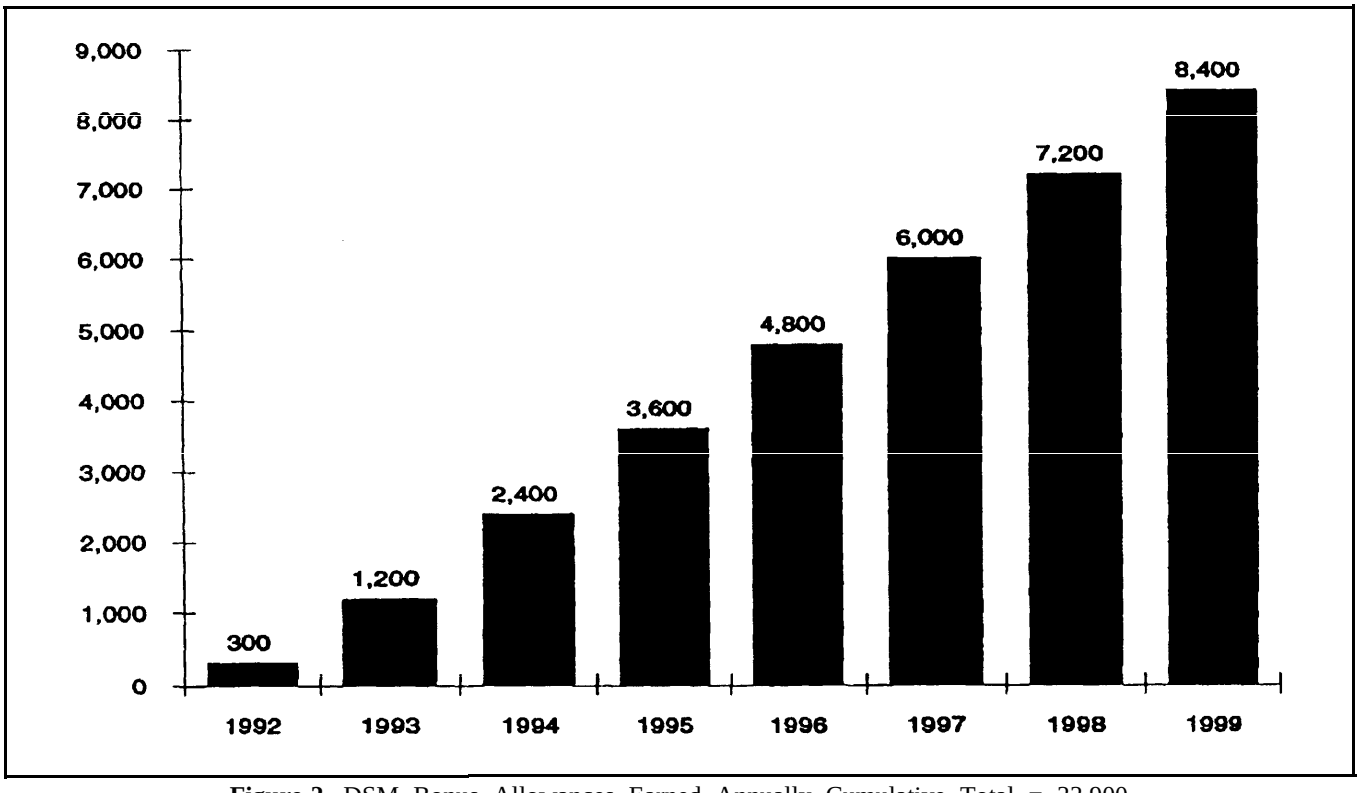

Figure 2. DSM Bonus Allowances Earned Annually Cumulative Total = 33,900

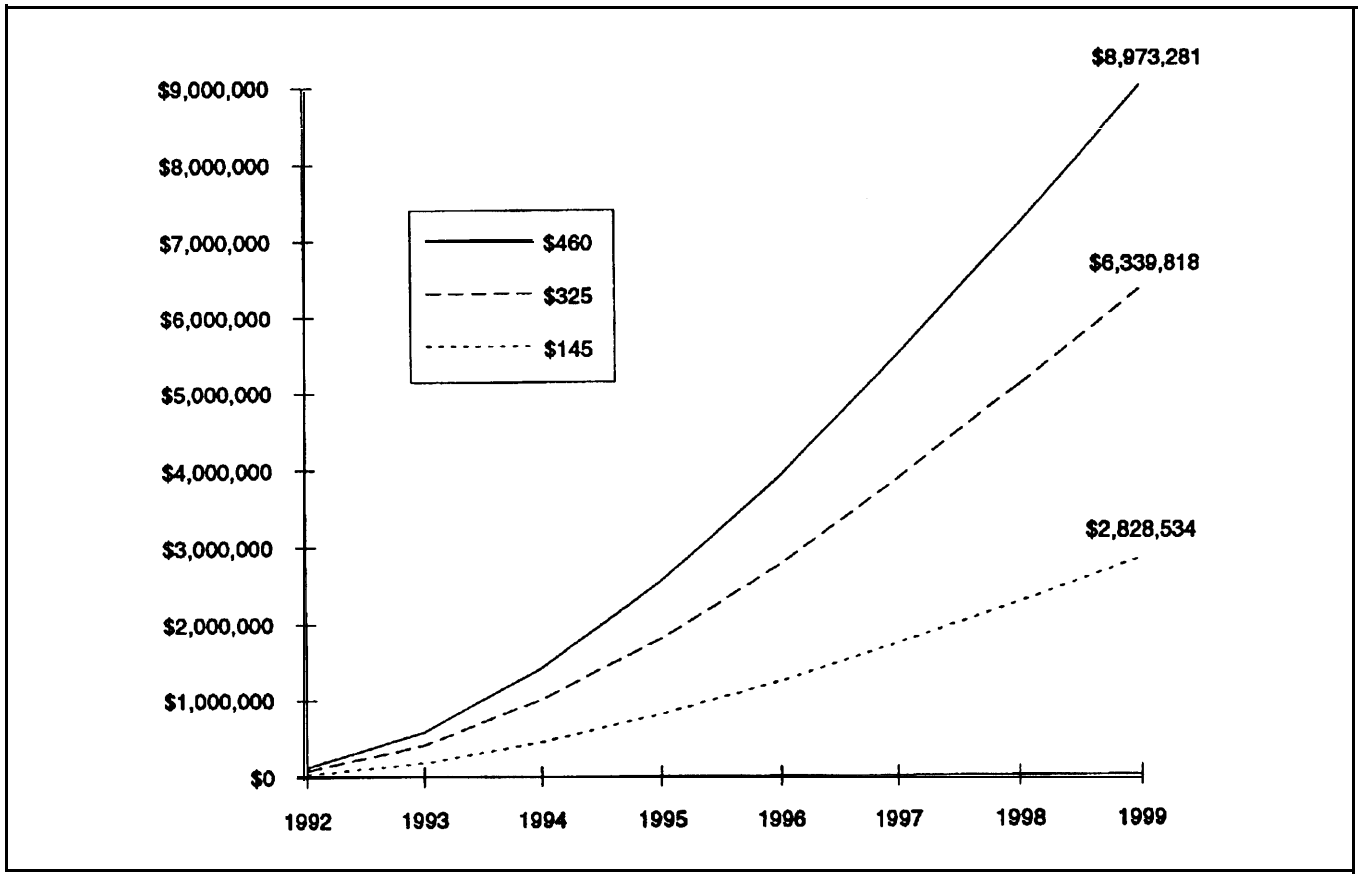

Figure 3. Net Present Value of Cumulative Bonuses at Various Market Rates

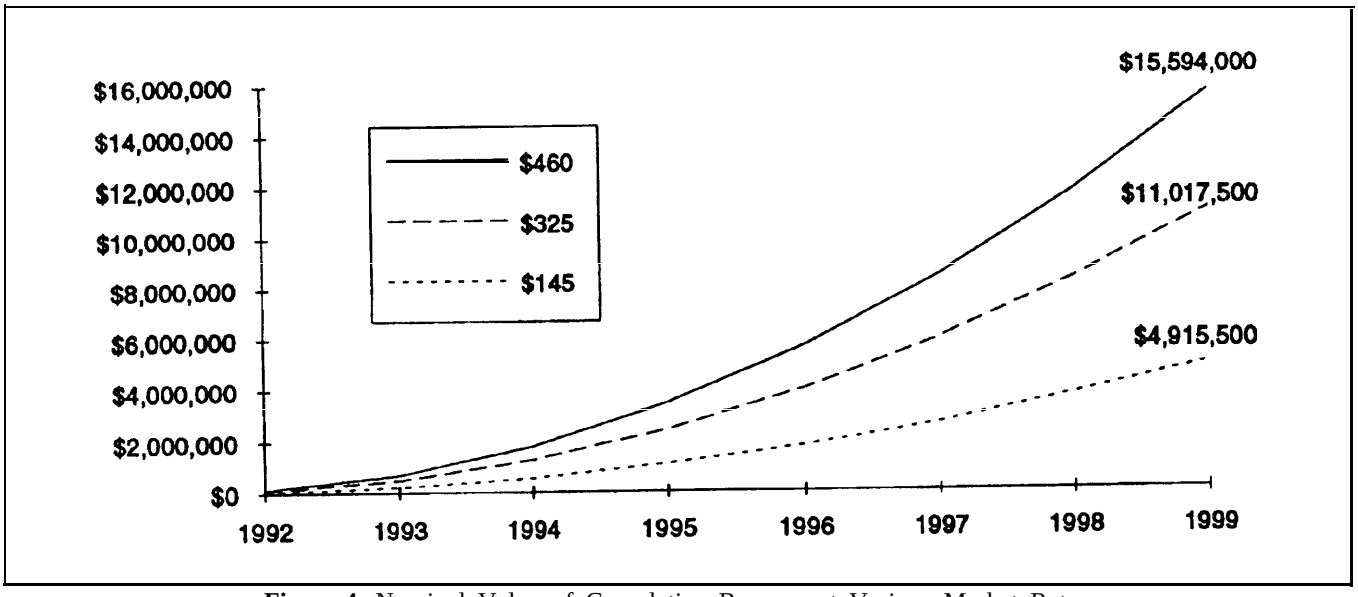

Figure 4. Nominal Value of Cumulative Bonuses at Various Market Rates

Reduced Utilization is an option under the Clean Air Act available to utilities with Phase I units. It provides allowances for DSM, supply-side efficiency, and/or renewable generation installed anytime after January 1988. Having no Phase I units, Edison is not eligible for Reduced Utilization.

While it may be true that avoided emissions and Reduced Utilization can affect the cost-effectiveness of some DSM programs, we want to concentrate on the impact of the bonuses.

A brief discussion of DSM cost-effectiveness is in order. In California, DSM programs are subject to California Public Utility Commission (CPUC) requirements for cost-effectiveness. To be eligible for funding, most DSM programs, including the resource conservation programs we are considering here, must pass both the Total Resource Cost (TRC) test and the Utility Cost (UC) test. The TRC test measures the benefits of DSM programs against costs paid by society, including program administration costs, while the UC test pits these benefits versus the total utility costs to deliver the program (i.e., program incentive costs plus program administrative costs). In formulas, these tests are represented as a benefit-cost ratio (BCR) and a net present value (NPV):

$$TRC\ BCR = RBn \,/\, (IMCn + PAC) \quad (1)$$

$$TRC\ NPV = RBn - IMCn - PAC \quad (2)$$

$$UC\ BCR = RBn \,/\, (PIC + PAC) \quad (3)$$

$$UC\ NPV = RBn - PIC - PAC \quad (4)$$

where RBn = resource benefits of a DSM program net of free riders;
IMCn = incremental measure cost of measures installed because of the program net of free riders;
PIC = program incentive costs, including rebates paid by the utility to customers, dealers, and manufacturers; and
PAC = program administrative costs.

Resource benefits (Rbn) are the net present dollar value of energy savings and capacity reductions. They are calculated using the program's Kwh savings, Kw reductions, net-to-gross adjustments for free riders, energy and capacity load shapes, measure lives, and net present value marginal costs of energy and capacity. Edison's marginal costs include externality adders for various pollutants, in addition to SO_2, and are substantially lower than average costs .

Our analysis compares the net present value of each program year's earned bonus allowances at the three market rates (see Table 2) to the resource benefits from the conservation programs eligible for bonuses. As shown on Table 3, the resource benefits for program year 1992 (300 Gwh) are $116 million. For 1993 (600 Gwh), they are $232 million and we assume that they will remain at that level through 1999.

Also shown on Table 3 are the percent increases to resource benefits from adding the net present value of a program year's allowances. The biggest impact of the bonuses is on program year 1992 because its savings are eligible for bonus allowances longer than any other program year. Even with eight years of eligibility, however, the value of the bonus allowances is only 0.4% to 1.2%.

These impacts of less than 1% to 2% of resource benefits for DSM programs are not likely to change a non-cost-effective program into a cost-effective program.

Yet, a program that saves 500 Mwh to earn a bonus allowance is likely to be cost-effective before bonuses, and that, perhaps, is an important point. Bonus allowances will be awarded to utilities with active, already cost-effective, and (because of the 500 Mwh/allowance requirement) sizable DSM programs. Based on our analysis of Edison's expectations here, the bonuses themselves will not materially alter the cost-effectiveness of programs.

Applying for Bonus Allowances

Nevertheless, Edison intends to take full advantage of the Clean Air Act's bonus allowances. Not for reasons of improving the cost-effectiveness of DSM, as we've seen, but rather for the potential value of the bonuses. Although small compared to Edison's earnings, the value of the bonuses must be weighed against the incremental costs of achieving these bonuses. These costs are: doing the DSM; a one-time application to DOE for certification of net income neutrality; and the annual application to the EPA.

Doing the DSM

Our analysis shows that, at least for Edison, these bonuses are not going to change a utility's commitment to DSM. Either you do DSM or you don't. In Edison's case, the commitment to DSM has been strong for several reasons. First, DSM is cost-effective, which, by definition, means that it is cheaper than the marginal cost of supply.

Table 2. Value of Bonuses at Various Market Rates by Program Year

		NPV of Bonuses at Various Market Rates		
Program Year	**Bonuses**	**$145**	**$325**	**$460**
1992	4,500	$424,593	$951,674	$1,346,985
1993	7,800	$768,014	$1,721,411	$2,436,458
1994	6,600	$678,724	$1,521,279	$2,153,195
1995	5,400	$580,506	$1,301,134	$1,841,605
1996	4,200	$472,466	$1,058,975	$1,498,857
1997	3,000	$353,621	$792,600	$1,121,833
1998	1,800	$222,893	$499,587	$707,107
1999	600	$79,091	$177,273	$250,909
Cumulative Total	33,900	$2,828,534	$6,339,818	$8,973,281
Total without NPV	33,900	$4,915,500	$11,017,500	$15,594,000

Table 3. Bonuses Impact on DSM Cost-Effectiveness

	Resource Benefits	% Increase at Various Market Rates		
Program Year	**($ millions)**	**$145**	**$325**	**$460**
1992	116	0.4%	0.8%	1.2%
1993	232	0.3%	0.7%	1.1%
1994	232	0.3%	0.7%	0.9%
1995	232	0.3%	0.6%	0.8%
1996	232	0.2%	0.5%	0.6%
1997	232	0.2%	0.3%	0.5%
1998	232	0.1%	0.2%	0.3%
1999	232	0.0%	0.1%	0.1%

Second, regulatory policy in California has stripped away disincentives to DSM and, further, offers significant opportunities for earnings from DSM. And third, DSM continues to be one of the best ways to work with customers. By assisting residential and nonresidential customers alike to achieve greater energy efficiency, Edison's DSM can enhance the regional economy.

DOE Certification of Net Income Neutrality for DSM

The Clean Air Act requires that participating investor-owned utilities gain certification from the Department of Energy for net income neutrality for their DSM efforts. This is, perhaps, the greatest difficulty in getting bonus

allowances. Our analysis suggests that if net income neutrality does not exist, then the value of the bonuses alone would not warrant any major effort to bring it about. Edison is fortunate, though, because it has all the elements required for certification. California investor-owned utilities have had full cost-recovery of DSM expenditures since the mid- 1970's. Edison has had an Electric Revenue Adjustment Mechanism, which adjusts revenue for fluctuations in energy sales due to DSM (and weather, etc.), since 1982. Finally, starting in 1990, Edison has been eligible for shareholder earnings from its DSM programs. Recently, the CPUC reiterated that shareholder earnings for DSM were necessary and will remain in the future. For Edison, then, the request for certification requires nothing new, but rather a one-time summation of existing policy written and presented well enough for the DOE to review and approve.

Application to the EPA for Bonus Allowances

The application itself is a definite, but perhaps deceptive, product of the Paperwork Reduction Act. It is a two-sided piece of paper requiring about 10 blanks to be filled in and two signatures. (The four-page instructions estimate 78 hours to complete the form.) The onerous task in completing the application is verifying the energy savings. If a utility is not subject to the ratemaking jurisdiction of a State regulatory authority (e.g., a municipal utility), then the utility must submit documentation to EPA to verify savings. These applicants may use the EPA Conservation Verification Protocol; a guide that includes, among other methods, prespecified savings for certain common DSM measures. Applicants subject to a State regulatory authority (e.g., investor-owned utilities) must use the State's verification methodology, if there is one in place for performance-based rate adjustments. In other words, the EPA relies on the verification process, if any, implemented by the State regulatory body. This gets a little confusing. Fortunately, Edison fits into the latter category. Because Edison already carries out an extensive verification of savings in order to earn from its DSM programs, its application to the EPA should be approved with little difficulty. Once again, this requirement boils down to repackaging information already provided.

Which is not to say that applying for DSM bonus allowances is "cost-less." There is a burden associated with pulling together this information, learning what is needed, reading (and rereading) the Federal Register (!), requesting and receiving approval from regulators, and initiating a whole new annual requirement at an ever-changing utility.

We can surmise, though, that this burden (which even with Edison's good fortunes is greater than 78 hours) is not so costly as to prevent a utility from acting if there is benefit for its shareholders and ratepayers. Our analysis shows that such a benefit is not derived from the enhancement of DSM, as the EPA has suggested, because benefits from avoided supply costs are so significant to start. Rather, the overall value of the 33,900 bonuses to Edison and its ratepayers—ranging in net present value from $3 million to $9 million and reaching a nominal value as much as $15.6 million—certainly warrants the pursuit of 11% of the Conservation and Renewable Energy Reserve.

The question remains if the Clean Air Act bonus allowances will spur other utilities and their regulators to achieve 500 Mwh in DSM savings, adopt net income neutrality, and establish a verification process? The reader may ponder this question; we'll leave our predictions for the closed-door sessions of the 1994 Summer Study.

Caveat

This analysis has been based on current regulatory practice in California and Edison's most recently adopted resource plans. Several issues have emerged in recent months—namely, an IRS ruling on taxing DSM expenditures and a regulatory proposal to restructure California's electric utility industry-that might have an adverse effect on Edison's DSM plans. Speculation on these issues is beyond the scope of this paper, except to point out that Edison's actual 1995 to 1999 DSM energy savings might be drastically lower than projections used in this analysis.

Acknowledgments

Although the paper draws on the author's experiences while working for Southern California Edison Company, the views expressed herein are entirely his own. The author would like to thank colleagues Don Arambula and Susan Heard for their work on this issue. The author also deeply appreciates the excellent editing suggestions provided by David Briery and, especially, Dr. Jim Young. Lastly, the author would like to thank Dr. Barry Solomon, whose introduction to the Conservation and Renewable Energy Reserve at the 1992 ACEEE Summer Study initiated the idea for this paper. Perhaps the best thing about the Reserve is that it directly ties DSM to marketable allowances, which gives the DSM professional a clear excuse to crossover to the possibly even more exciting field of emissions trading.

References

"Acid Rain Program; Final Rule." January 11, 1993. *Federal Register*. 40 CFR Part 72. Vol. 58, No. 6. Environmental Protection Agency, Washington, D.C.

Bohi, D. R. March 1994. "Utilities and State Regulators Are Failing to Take Advantage of Emission Allowance Trading." *The Electricity Journal.* Volume 7, Number 2, pp. 20-27. Robert Owen Maritz, Seattle, WA.

"Conservation/Renewables Reserve Form and Instructions." January 1993. EPA Form 7610-10 (l-93). United States Environmental Protection Agency, Washington, D.C.

"Energy Efficiency and Renewable Energy." February 1994. *Opportunities from Title IV of the Clean Air Act.* EPA 430-R-94-001. United States Environmental Protection Agency, Washington, D.C.

Hahn, R. W., and C. A. May. March 1994. "The Behavior of the Allowance Market: Theory and Evidence." The *Electricity Journal.* Volume 7, Number 2, pp. 28-37. Robert Owen Maritz, Seattle, WA.

Mason, T. March 4, 1994. "Emission Allowance Trading Behavior Selling in an Uncertain Environment." *Clean Air Response: Achieving Compliance in an Evolving Market,* EPRI Workshop.

"SO_2 Emission Allowances Become The New Paradigm in Utility Planning." *Electric Light and Power.* February 1992. p. 13. Penwell Publishing Co., Barrington, IL.

Solomon, B. D., J. A. Kruger, and R. E. Morgan. August 1992. "The Quantification and Verification of Energy Savings for Acid Rain Compliance." *ACEEE 1992 Summer Study on Energy Efficiency in Buildings.* PP. 9.169-9.177. American Council for an Energy Efficient Economy, Washington, D.C.

Southern California Edison Company. 1993.1993 *Annual Report: Focus on Competitive Performance.* p. 40. SCEcorp Rosemead, CA.

Southern California Edison Company. March 1993. *Annual DSM Summary Report 1992 Results-1993 Plans.* p. 8.6. Rosemead, CA.

Southern California Edison Company. April 1994. *Annual DSM Summury Report 1993 Results-1994 Plans.* pp 1.6 & 8.5. Rosemead, CA.