Demand-Side Bidding: Six Years Later and the Results Are Coming In

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In DSM bidding programs, utilities and developers of DSM resources sign long-term contracts to provide a quantity of demand and energy savings at specified prices. Since 1987, about 30 utilities in 14 states have solicited bids from energy service companies (ESCOs) and customers to reduce demand in commercial and industrial facilities and residences. Total resource costs range between 5.4- 8¢/kWh for 10 DSM bidding programs where complete information on program costs is available. Several of these initial bidding programs appear to be only marginally cost-effective from a societal perspective. In most bidding programs, payments to bidders account for between 70 - 90% of total program costs. Our analysis suggests that variation in winning bid prices is influenced primarily by DSM bid ceiling prices, differences in the mix of measures and markets targeted by developers, and the degree of performance risk borne by the DSM developer. Bids targeting residential customers averaged 6.2¢/kWh compared to about 5.¢/kWh for commercial/industrial bids. We also compared the costs of acquiring lighting savings in DSM bidding contracts with a sample of 20 utility-sponsored commercial/industrial lighting programs. We found that, on average, total resource costs were slightly higher in bidding programs (6.1 vs. 5.6¢/kWh).

Introduction

U.S. utilities continue to experiment with various approaches that allow developers of demand-side resources to propose projects in competitive bidding solicitations (Wolcott and Goldman 1992). The bids of DSM developers are typically structured as the price to supply specified amounts of savings, either kW demand reductions, kWh savings, or some combination of both. To date, about 30 utilities had conducted bidding programs in which DSM projects were eligible. ESCOs and customers have proposed about 1,500 MWs of demand reductions in these programs; utilities have selected over 170 DSM bids representing approximately 425 MWs.

In this paper, we summarize results from a comprehensive study that examines utility experiences with demand-side management (DSM) bidding programs (Goldman and Kito 1994). We focus primarily on the costs of these programs, but also compare the cost of lighting contracts in DSM bidding programs with a sample of utility-sponsored C/I lighting rebate programs. This type of comparative analysis is important because provides insights on the relative merits of alternative delivery mechanisms (e.g., DSM bidding vs. other types of utility DSM programs).

DSM bidding programs represent a set of diverse, large-scale experiments to acquire demand and energy savings from third party providers based on pay-for-performance contracts. Interest among regulators (and some utilities) in competitive procurement of DSM resources continues to increase, although DSM bidding programs account for only a small amount of the savings (~5%) currently achieved by utility DSM efforts nationally. However, from a policy perspective, DSM bidding is an important phenomenon because it provides a competitive benchmark to help assess utility performance in acquiring cost-effective DSM resources and because it encourages performance-based DSM programs in which DSM savings are guaranteed and maintained over the long-term.

Approach

In order to calculate the total resource cost of each bidding program, we collected information on program costs (including utility payments to DSM developers, utility administrative costs, and costs incurred by host customers), annual energy and peak demand savings, and contract and project lifetimes. One difficulty in comparing costs among programs is that payment structures vary from contract to contract and also among utilities.

Winning bidders typically receive either a one-time upfront payment, payments that are front-loaded in the early years of the contract, or payment streams that are levelized or ramped upward over the contract term. Payments for energy savings are often time- or seasonally-differentiated as well. In order to compare contracts with varying payment streams, levelized costs (in ¢/kWh) were calculated for each individual contract. [1] Because of confidentiality y concerns, levelized costs for individual projects were then aggregated to the utility program level, weighted by energy savings.

We report levelized costs in *nominal* dollars and did not adjust for the effects of varying start dates among projects. Converting nominal costs into constant (e.g., 1993) dollars would have a relatively small impact on overall results among utilities because inflation rates have been low during the past five years and are expected to remain so for the near future. If we had made this adjustment, costs of recent bidding programs would appear relatively more favorable compared to early programs.

Information on bid payments was typically obtained from signed contracts between DSM developers and utilities. Utility administrative costs were obtained from DSM filings or provided by program managers. For consistency, we included costs associated with program implementation and evaluation, and excluded costs associated with RFP development, bid evaluation, and contract negotiations. We excluded administrative costs incurred during the initial phase for all utilities because of data quality problems and methodological concerns. [2] We also found that few utilities have systematically collected data on *actual* customer contributions to the costs of installed measures. For some utilities, estimated customer costs were included in contracts (e.g., New Jersey, New York). We verified and revised these figures drawing from actual implementation experience (where available). ESCOs also provided us with estimates of customer cost contributions in some cases.

To calculate levelized costs (in ¢/kWh), we used actual savings accomplishments or the annual energy and peak demand savings specified in the contract. Contracts executed by four utilities specified only the required demand reductions and, in these cases, we estimated the annual hours of operation in order to estimate electricity savings. [3] We found that "free riders" are rarely considered in measurement and verification plans in our review of contracts signed in DSM bidding programs. It is more common for utilities to address "free rider" concerns during the design of bidding programs (e.g., threshold requirements that establish minimum payback period for DSM measures) or in selecting among competing bidders during bid evaluation.

A common discount rate was used in order to facilitate comparisons among programs. For this purpose, we chose a nominal discount rate of 11%, which is representative of the weighted average cost of capital for utilities in this study at the time bidding RFPs were issued.

We used the contract term to establish the economic lifetimes for individual projects. This approach provides a conservative estimate of total resource costs to the extent that energy savings extend beyond the term of the contract. In contrast, evaluations of utility DSM rebate programs often use equipment lifetimes to determine economic lifetimes, although more utilities have recently begun to adjust economic lifetimes to reflect application-specific considerations (e.g., remodeling of office space, probability of premature retirement) explicitly in developing economic lifetime estimates (Eto et al. 1994). Contract terms ranged between three and 25 years for individual projects. [4] We then computed an average contract term for each utility program, weighting individual contracts by their kWh savings. At this more aggregate level, contract terms ranged between 7 - 16 years. In theory, one would want to normalize all projects to a standardized planning horizon in order to account for "end effects." However because of methodological difficulties and data limitations, we concluded that it was preferable to report levelized costs for bidding programs and indicate assumed economic lifetimes explicitly, rather than introduce additional uncertainties into the analysis. [5]

Data Quality

The quality of data on program costs and energy savings are quite uneven among utilities. We developed confidence rankings in three major areas for each utility, which indicates our assessment of data quality: payments to winning bidders (including accuracy of energy savings), the utility's program administrative costs, and costs incurred by the customer (see Table 1). Data quality is primarily related to the type and scope of program information that is publicly available, the extent to which utilities (and ESCOs) were willing to provide data, and program maturity. We estimate total resource costs only for those DSM bidding programs that had a confidence ranking of C or higher for each cost component.

Costs of DSM Bidding Programs

Levelized total resource costs (TRC) range between 5.4-8.0¢/kWh for 10 utility DSM bidding programs (see Table 2). For comparison, we also show each utility's avoided supply costs (at the time of the RFP) for the selected projects. While the sample is small, there is some evidence that total resource costs are coming down somewhat over time, both in terms of absolute costs and as a percentage of the utility's avoided supply costs. For

Table 1. Confidence Rankings for Program Costs

Confidence Ranking	Comments

Payments to Bidders

A	LBL reviewed individual contracts and analyzed payment schedules
B	Utility provided payment schedules for individual contracts with documentation
C	Utility provided aggregated (i.e., program-level) information on utility payments and estimated savings; or contract provides for payment in $/kW based on demand reduction and LBL obtained information on actual or estimated hours of operation
D	Utility provided average levelized bid prices or range of values without documentation
F	Utility provided average payment in terms of $/kW, but was unable to provide estimated hours of operation

Administrative Costs

A	Utility provided administrative costs based on actual implementation experience, with actual expenditures and projected budgets
B	Utility provided administrative costs based on projected budgets
C	Utility provided steady-state staffing estimates
D	Utility provided estimated administrative costs without documentation
F	Utility unable to provide any information on administrative costs

Customer Cost Contributions

A	Utility or ESCO provided information on customer contributions on a contract-by-contract basis, with good documentation
B	Contract caps customer cost contributions at difference between bid payments and avoided supply costs; maximum customer cost value shown
C	ESCOs provided estimates of customer contributions; quality of the data varies across contracts
D	LBL developed estimates of customer contributions by analyzing Utility Cost Test and TRC Test results from utility's bid evaluation; these are rough estimates only
F	No information on estimated or actual customer costs

example, total resource costs in the more recent programs in New York and California are in the 5 - 6¢/kWh range compared to the initial programs offered by New Jersey utilities, where total resource costs ranged from 6.5 - 8¢/kWh.

The results in New Jersey may be an artifact of the program design implemented by the utilities based on a settlement agreement. DSM bids were evaluated and scored relative to each utility's avoided supply costs as part of integrated supply and DSM solicitations. Estimated customer costs were not included in the price score

explicitly, but were capped at the difference between bid price and avoided supply cost as a threshold requirement. Although the bidding programs of several other utilities were integrated supply and DSM RFPs, maximum DSM bid prices were constrained either by lower ceiling prices (Con Edison), an economic analysis which utilized multiple benefit-cost tests (Niagara Mohawk), or program designs which explicitly indicated that bids would be judged on their value relative to the utility's own DSM programs and avoided supply costs (Central Maine Power).

Table 2. Total Resource Costs of Ten DSM Bidding Programs

Utility	Contracts Analyzed (#/MW)	Levelized Total Resource Cost (TRC)(1) (¢/kWh)	Utility Avoided Supply Cost (¢/kWh)	TRC as % of Avoided Cost	Avg. Contract Term (years)	Approx. Start Date of Contracts
BECo	84+/21	7.3	7.6	96	10	1988
CMP	6/17	6.5	6.9	94	14	1989
ORU-NJ	4/6	6.5	8.5	77	15	1991
ORU-NY/2	4/10	7.5	9.0	82	10	1990
JCP&L/3	2/10	8.0	8.9	90	15	1991
PSE&G/4	7/39	7.1	6.9	104	10	1992
NMPC	5/20	5.4	9.6	57	15	1991
LILCO	2/7	6.6	9.2	72	7	1991
Con Edison	2/6	5.6	13.3	42	14	1992
PG&E/5	10/18	6.9	8.6	80	10	1994

Notes to Table 2:

1. Shareholder incentives not included in these calculations.
2. The utility includes all bill savings paid from the customer to the ESCO as part of customer contributions.
3. Includes results for only 2 of 4 contracts. One project was cancelled, the other is a thermal storage project.
4. Includes all but the thermal storage project. Includes upper bound of customer contributions (which explains why TRC exceeds avoided cost).
5. In many cases, PG&E believes measure lifetime exceeds contract term. Levelized TRC values would be 5.1 ¢/kWh and the avoided supply cost 11.0 ¢/kWh if these additional savings are included.

Payments to bidders account for between 70 - 90% of total program costs in most of these bidding programs. Cost contributions from host customers are not particularly significant, with two notable exceptions: LILCO and Orange and Rockland - New York (see Figure 1). At these two utilities, it appears that host customers did pay or will ultimately pay a significant portion of the installed costs of projects at their facilities either through upfront payments or out of bill savings, in part because payments to DSM bidders were constrained rather sharply by low ceiling prices. However, total resource costs of the LILCO and Orange and Rockland (NY) bidding programs are not among the lowest in our sample of utilities either in absolute terms or as a percentage of the utility's avoided supply costs.

Table 3 summarizes aggregated results for the various program cost components (e.g., utility payments to DSM bidders, utility administrative costs, and estimated customer cost contributions, when available) for a larger sample of 18 programs. Information is also included on confidence rankings for each utility, ceiling prices for DSM bids, bid payments as a percent of ceiling price, and estimated start dates and weighted-average contract term of the projects.

Utility Administrative Costs

Administrative costs range between 0.0 - 0.8¢/kWh, with a median value of 0.4¢/kWh, for the 15 programs where data are available. The variation in administrative costs among utilities is partly attributable to varying degrees of marketing support and assistance offered to ESCOs. In most bidding programs, utility field staff are not involved in program marketing. Other factors that explain the variance in administrative costs among utilities include differing assessments of utility staff time that is being devoted or will be required for monitoring contract
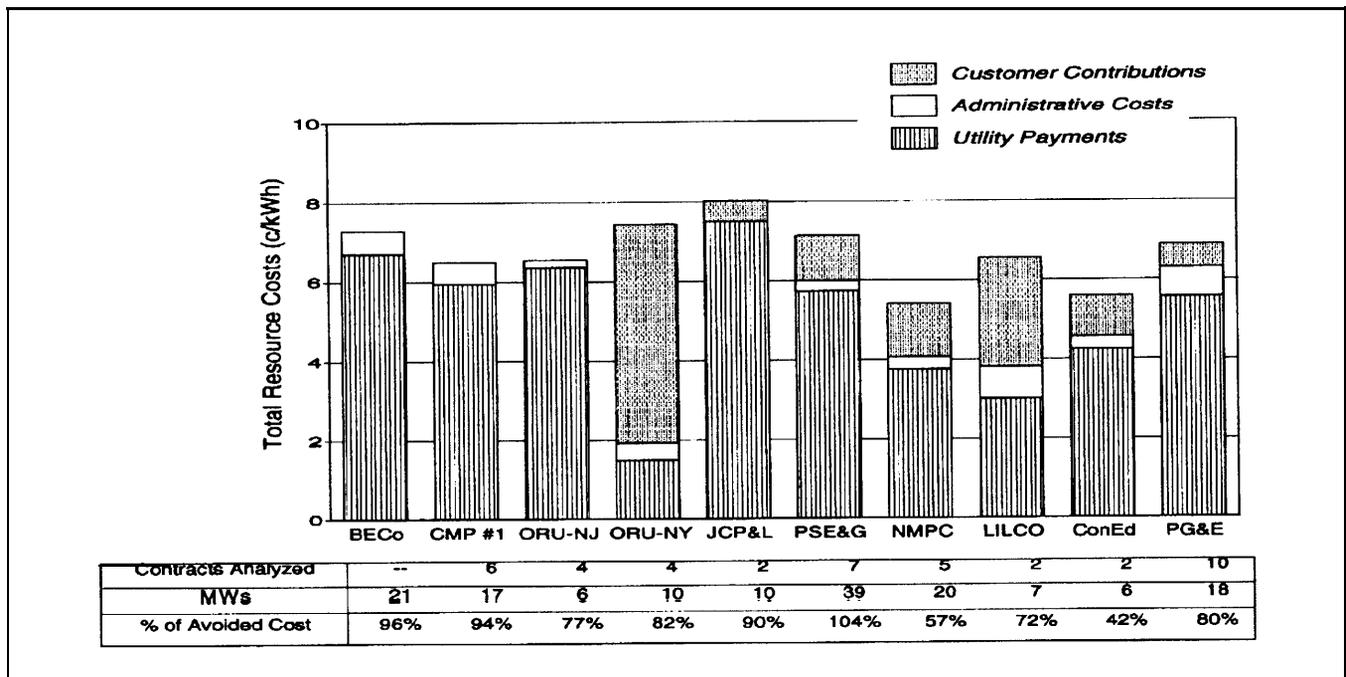
Figure 1. Total Resource Costs for Ten DSM Bidding Programs

implementation, program evaluation activities, and differences in cost accounting procedures among utilities. For example, several utilities could not provide implementation and monitoring costs for DSM bidding programs separately because administrative costs are aggregated together for the relevant market segment (e.g., residential) or for all DSM programs.

Customer Costs

Lack of data on actual customer costs and the poor quality of existing data on estimated customer cost contributions among utilities limits our ability to draw more definitive conclusions on this cost component. Thus, we offer only a few preliminary observations. First, with several exceptions, it is unlikely that customer costs represent a significant portion of total program costs in these DSM bidding programs. Customer costs range between 0.0 - 1.5¢/kWh for 10 of 13 utility bidding programs where this information could be collected. Second, ESCOs that target projects at C/I customers have been able to get some host customers to pay a significant fraction of project costs, depending on the design of the bidding program. Third, it appears that ESCOs involved in the residential market typically do not obtain cost payments from participating households.

Utility Payments to DSM Developers

Not surprisingly, there is substantial variation in the bid prices of individual contracts both within a particular

utility DSM bidding program as well as across utilities. For example, winning bid prices range between one to five ¢/kWh for one utility in New York. The primary factors that account for much of this variation include: (1) differences in the allowed ceiling prices of DSM bids among utilities, (2) differences in mix of measures, services offered, and market sectors targeted by DSM bidders, (3) the degree to which performance risks are borne by DSM bidders as reflected in contract provisions, and (4) perceived competitors which may be related to the type and size of solicitation. Our results provide an indication of the relative importance of each factor, although confounding influences and limited information argue for caution in drawing definitive conclusions.

DSM Bid Ceiliog Prices. Differences in the allowed ceiling prices of DSM bids appear to explain much of the observed variation in bid prices among DSM bidding programs. Figure 2 shows aggregated bid payments for 18 bidding programs, the DSM bid ceiling price in those solicitations (shown with a line), and, for comparison, the utility's avoided supply costs (shown by a diamond). There is a direct correlation between high ceiling prices (which are typically based on the utility's avoided supply cost) and the bid prices of winning bidders. For the New Jersey utilities, where the avoided supply costs were relatively high at the time of the bidding RFPs, utility payments to DSM developers are correspondingly high, ranging from 5.8¢/kWh to 7.5¢/kWh. On the other hand, payments to DSM bidders tend to be substantially lower (1.5 - 4.9 ¢/kWh) among utilities such as LILCO,

Table 3. DSM Bidding Program Cost Components

Utility	Levelized Utility Pymts. to Bidders (¢/kWh)	Conf. Rank*	Utility Admin. Costs (¢/kWh)	Conf. Rank	Cust. Contr. (¢/kWh)	Conf. Rank	DSM Bid Ceiling Price (¢/kWh)	Bid Pymts. as % Ceiling Price	Avg. Contr. Term	Approx. Prgm. Start Date
NEES/1	3.5-6.1	C	NA	F	NA	F	NP	--	3-7	1989
BECo/2	6.7	C	0.6	A	0.0	A	7.6	88%	10	1988
CMP#1/3	5.8-6.1	B	0.6	A	0.0	C	6.6-7.2	85-88%	14	1989
CMP#2/4	5.6-6.0	B	0.6	A	NA	F	NP	--	11	1990
ORU-NY/5	1.5	C	0.4	A	5.5	C	1.8	81%	11	1990
ORU-NJ	6.4	A	0.2	A	0.0	A	8.5	75%	15	1991
Puget #1/6	4.9	D	0.1	D	NA	F	5.0	98%	11	1990
JCP&L/7	7.5	A	0.0	A	0.5	B	8.9	84%	15	1991
PSE&G/8	5.7	A	0.3	C	1.2	B	6.9	83%	10	1992
NMPC/9	3.8	A	0.3	A	1.4	C	9.6	39%	15	1992
LILCO/10	3.0	C	0.8	A	2.7	C	3.5	86%	7	1991
Con Edison/11	4.2	B	0.3	B	1.0	C	5.5	77%	14	1992
NYSEG/12	4.5	A	NA	F	0.7	D	9.9	46%	16	1992
RG&E/13	4.2	A	NA	F	1.5	C	5.4	77%	15	1993
PSColo #1/14	2.7	F	0.8	D	NA	F	NP	--	15	1991
SMUD/15	3.2	A	0.6	D	1.9	C	4.9	66%	10	1994
PG&E/16	5.6	A	0.7	B	0.6	A	8.6	65%	10	1994
PSColo #2/17	2.8	F	0.9	D	NA	F	NP	--	15	1994

* = Confidence Ranking
Notes to Table 3: NA = Not Available; NP = Not Applicable.
1. Range represents contract term (three years) and estimated measure lifetime (seven years).
2. BECo (1993).
3. The lower bound excludes residential contract.
4. The lower bound excludes residential contract.
5 The weighted bid price is $448/kW and the ceiling price is $550/kW. Annual energy savings calculated from load factors provided by the utility. Customer cost contributions include bill savings from customer to ESCO.
6. Puget provided aggregate information on payments to bidders for three of five contracts.
7. Includes two of four contracts because one contractor dropped out and other is a thermal storage contract.
8. Includes all but the thermal storage project.
9. Includes data on five contracts; two were cancelled.
10. Includes two of three contracts; one project was cancelled. The average bid price is $485/kW and the ceiling price is $562/kW. Energy saving estimates developed based on hours of operation provided by the utility and estimated measure lifetimes of 7 years.
11. The weighted bid price is about $1440/kW in net present value terms. Estimated energy savings provided by the utility.
12. Includes seven contracts; NYSEG is still negotiating with two bidders.
13. Includes results for two contracts.
14. The average bid price is $240/kW. This calculation assumes a 15 year contract life and a capacity factor of 12.6% (4.25 hours a day, five days a week). Administrative costs are estimated as 30% of bid payments
15. Includes results for two of three contracts.
16. The levelized prices over measure lives, which are estimated up to 22 years, are 3.7¢kWh (bid price) and 0.4¢/kWh (customer contribution). Shareholder incentives are 0.2 and 0.4/kWh over the contract lives and measure lives, respectively, but are not included in this table.
17. The average bid price is $250/kW. Identical assumptions were made for load factor as indicated in [14].
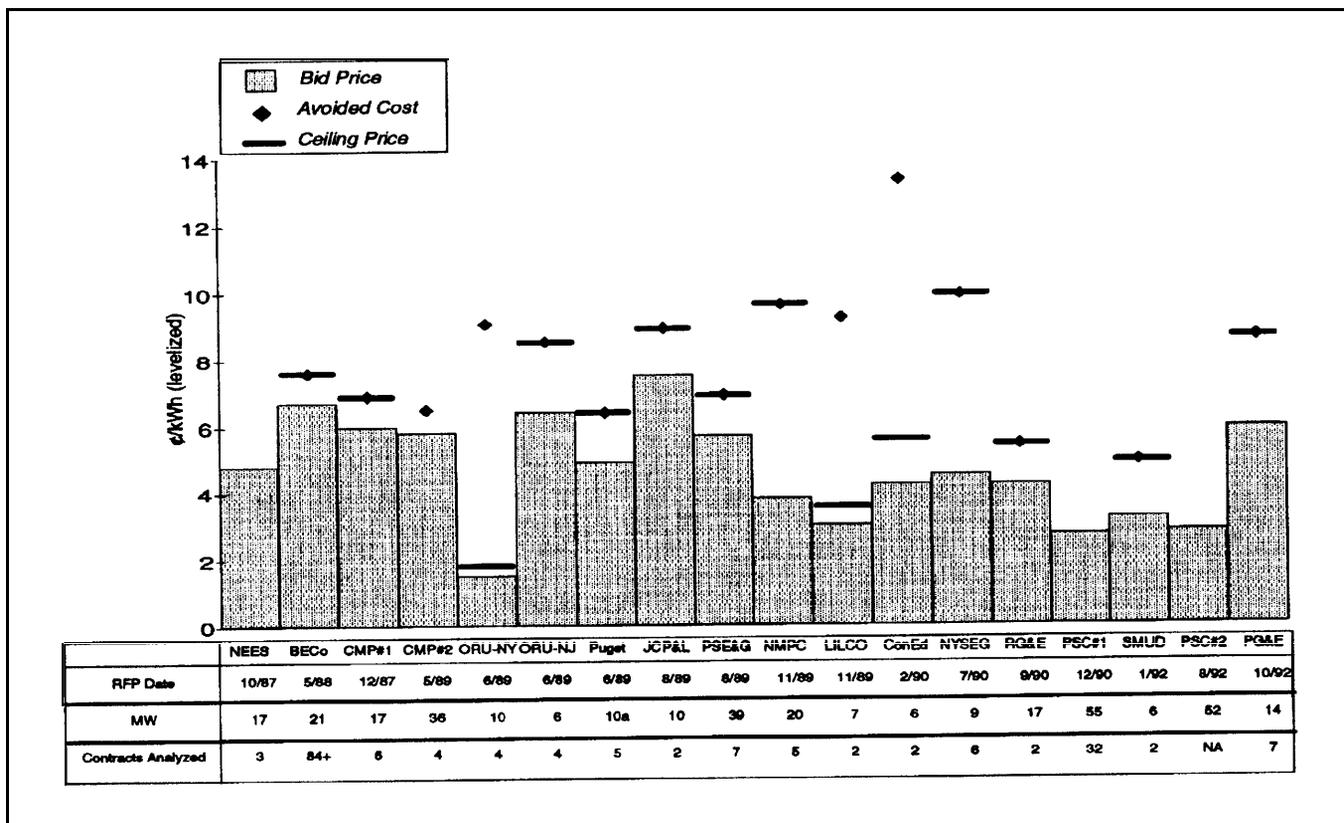
Figure 2. Utility Payment to Winnng Bidders

ORU-NY, Puget Power, Con Edison, and PSColo that established ceiling (and reference) prices for DSM bids that were below the utility's avoided costs.

While it is clear that DSM ceiling price levels were particularly important in early DSM bidding programs, they appear to be less determinative in several recent small DSM-only auctions. For example, in a 20 MW pilot, PG&E recently selected 10 projects with average bid prices of 5.6¢/kWh, which was far below the utility's estimated avoided supply cost of 8.6¢/kWh. SMUD has signed three contracts for an average price of 3.2¢/kWh, which was also well below their ceiling price of 4.9¢/kWh.

Target Markets and Mix of Measures. DSM bid prices also vary because bidders target different market segments and offer varying mixes of measures and services. For example, in our sample of 18 utility DSM bidding programs, slightly less than 90% of the contracted demand reduction is targeted at commercial/industrial (C/I) facilities, while about 10% is aimed at residential customers. Bids targeting residential customers average 6.2¢/kWh compared to 5.0¢/kWh for C/I bids (see Figure 3).

DSM bidders that offer comprehensive packages of measures in major end uses (e.g., lighting, HVAC, and

motors) account for almost 50% of the contracted MWs in our sample of bidding programs (199 MWs), while C/I lighting projects account for about 14% of the contracted MWs (53 Mws). We found that utility payments to DSM developers offering C/I comprehensive packages are slightly higher on average than payments for C/I lighting only contracts: 5.1¢/kWh vs. 4.5¢/kWh (see Figure 3).

Individual DSM measures vary significantly in terms of their lifecycle cost, which should affect bid prices. There is substantial variation in bid prices among both lighting and "comprehensive" contracts. For example, bid prices range from about 1.0 to 6.2¢/kWh among winning C/I lighting bidders. The low bid price represents a small industrial lighting project (with a contract term of 15 years) and the high bid price represents a commercial lighting project proposed by a customer bidder in California (with a contract term of 10 years). It is difficult to explain the variance in bid prices because, in some cases, we have limited information on the types and distribution of lighting efficiency measures that have been proposed or installed. Lower cost measures include relamping, replacement of incandescent lamps with fluorescent lamps, and installation of optical reflectors, while higher cost measures include changeouts of existing lighting systems, electronic ballasts, and various types of lighting controls. We do know that a few utilities valued lighting measures quite differently in their bidding programs.[6]
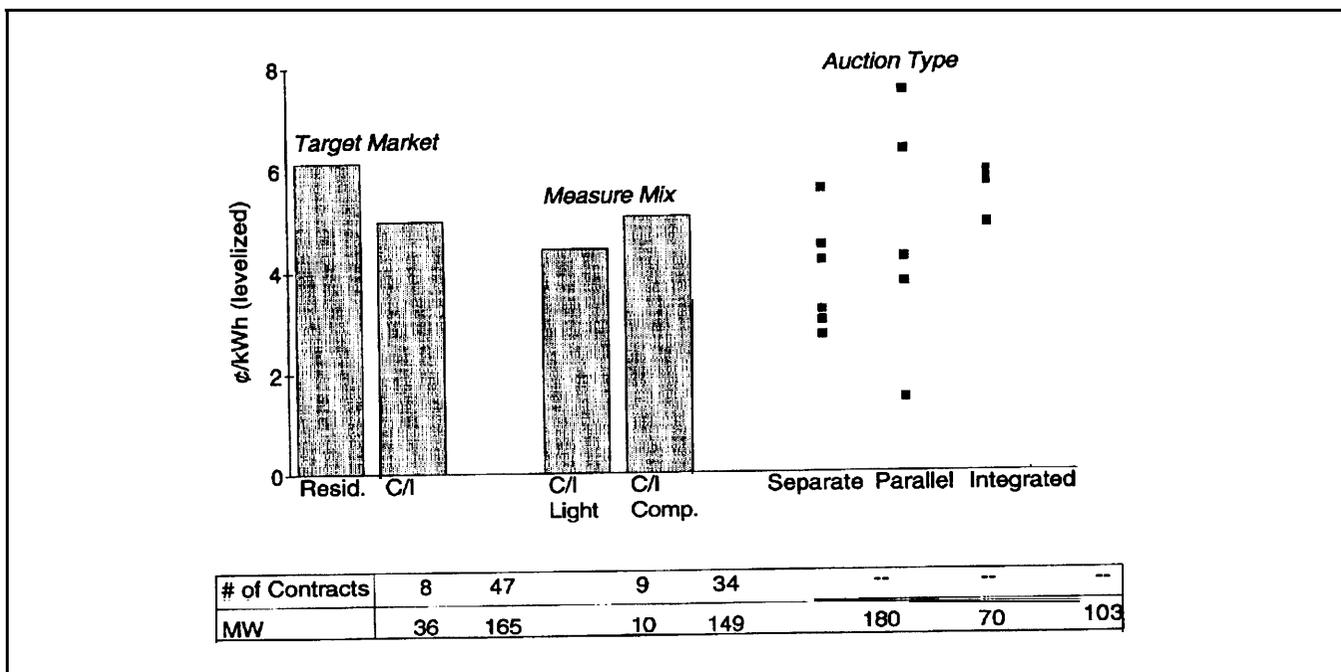
Figure 3. Other Factors that Influence Bid Payments

Bid prices varied between 1.4 - 9.9¢/kWh among DSM developers offering C/I comprehensive projects at various utilities. Variation in bid price undoubtedly reflect, in part, varying degrees of comprehensiveness of services and measures offered by DSM developers. It is important to note that ESCOs generally do not provide contractual guarantees regarding the mix of measures actually installed. In most bidding programs, it appears that lighting measures account for most of the savings (70 - 100%) from projects completed by ESCOs with comprehensive bids (see Table 4). The performance of CES/Way in Niagara Mohawk's bidding program is the notable exception to this trend.

Overall, these results are somewhat disappointing for at least two reasons. First, bid prices for these "comprehensive" contracts were evaluated and judged by utilities under the assumption that, in aggregate, ESCO would convince customers to select DSM options that improved energy efficiency among the major end uses. To the extent that utilities believe that they can obtain lighting savings with comparable reliability and persistence at lower cost, it appears that too much is being paid for this DSM resource. Second, if DSM bidders install only lighting, they may be creating "lost opportunities" which the comprehensive contracts were designed to avoid.'

Payment Provisions and Performance Guarantees. The degree of performance risk borne by DSM developers also appears to influence bid prices. For example, ESCOs were only required to verify that equipment had been installed properly in order to receive payments in LILCO's and ORU (NY)'s bidding program, which averaged 3¢/kWh and less. In contrast, contracts signed by utilities in New Jersey required ESCOs to demonstrate energy savings over a 10 - 15 year time period in order to receive payments, which averaged between 6-7¢/kWh.

Affect of Auction Type and Size on Perceived Competitors. Average payments to DSM bidders have been significantly higher for utilities that conducted integrated "all-source" RFPs compared to those utilities that conducted DSM-only RFPs or issued supply and DSM RFPs in parallel to meet a common resource block (see Figure 3). The resource block size in DSM-only RFPs tends to be significantly smaller than in integrated, "all-source" RFPs. Although integrated bidding RFPs include more potential competitors (i. e., independent power producers), the success rates of DSM bidders have been higher in auctions that include supply-side options compared to DSM-only RFPs (40% vs. 25%).[8] DSM bidders undoubtedly make some initial assessment of potential competitors and their relative competitive position, which may affect their bid pricing strategy, particularly if they are national ESCOs that have experience with various types of auctions. Thus, DSM-only solicitations may create more competition among potential DSM service providers as compared to integrated, all-source RFPs, in part because utilities can take account of DSM market potential explicitly in determining the size of the resource block.

Table 4. C/I Comprehensive Contracts: Savings from Measures Actually Installed

Utility	Total (MW)	On-Line (MW)	Ind. Process (%)	Lighting (%)	Motors (%)	HVAC (%)	Non-Electric Cooling (%)	Comments
NEES		17		70				
BECo		21		90	3	7		
CMP #1	10	10	36	64				
ORU-NY	10	4		100				
ORU-NJ	3	1		100				Initially, no M&V protocol for HVAC
JCP&L	10	6		100				Initially, no M&V protocol for HVAC
PSE&G	36	7		85	5	10		Initially, no M&V protocol for HVAC
NMPC	8	5		47	6	45		2% shell measures
LILCO	7	3		65			35	
Con Edison	7	4		98	2			Limited number of eligible measures

Cost Comparisons of DSM Bidding Versus Other Utility DSM Programs

In evaluating different DSM program delivery mechanisms, we believe it is useful to limit the comparison to programs that target similar customer classes and end uses. DSM bidding programs make such comparisons problematic because utilities typically sign contracts that encompass several customer classes and end uses. We decided to focus on C/I lighting because a reasonable sample of bidding contracts was available (i.e., nine) and there was also less ambiguity regarding actual measures installed (compared to C/I comprehensive or residential projects). In addition, results were available from a recent study from the Database on Energy Efficiency Programs (DEEP) of utility-sponsored lighting programs (Eto et al. 1994). Note that, in aggregate, the C/I lighting programs are much larger in size than the bidding projects (e.g., an order of magnitude in terms of savings).

As Figure 4 shows, the levelized total resource costs for the set of C/I lighting contracts from bidding programs are slightly higher on average compared to the sample of 20 utility-sponsored lighting programs (6.1 vs. 5.6¢/kWh). For each group, the reported mean value represents a weighted average, which was computed by weighting the costs of each individual bidding project or utility lighting program by its kWh savings. The fact that levelized TRC costs are roughly comparable is somewhat surprising because we would expect DSM bidding programs to be significantly more expensive than lighting programs given the development and performance risks being borne by DSM developers.[9] The most striking difference between the bidding projects and utility C/I lighting programs is the relative distribution of costs paid for by the utility (incentives and administrative costs) and the end-use customer. Customers bear a larger portion of the direct costs in the utility C/I lighting programs, whereas the utility bears most of the costs in the bidding programs. However, we believe that this phenomenon is primarily a result of poor design of bid scoring systems and auction type, rather than being an intrinsic feature of DSM bidding.[10]

The DSM bidding projects and utility C/I lighting programs also differ with respect to resource risks and the relative uncertainty in the TRC estimates. Measure lifetime and persistence of savings are the major sources of uncertainty in the TRC values for the utility C/I lighting programs. There is much less uncertainty regarding persistence of savings in DSM bidding programs compared to these utility C/I lighting programs because, in most cases, DSM developers have signed contracts guaranteeing the
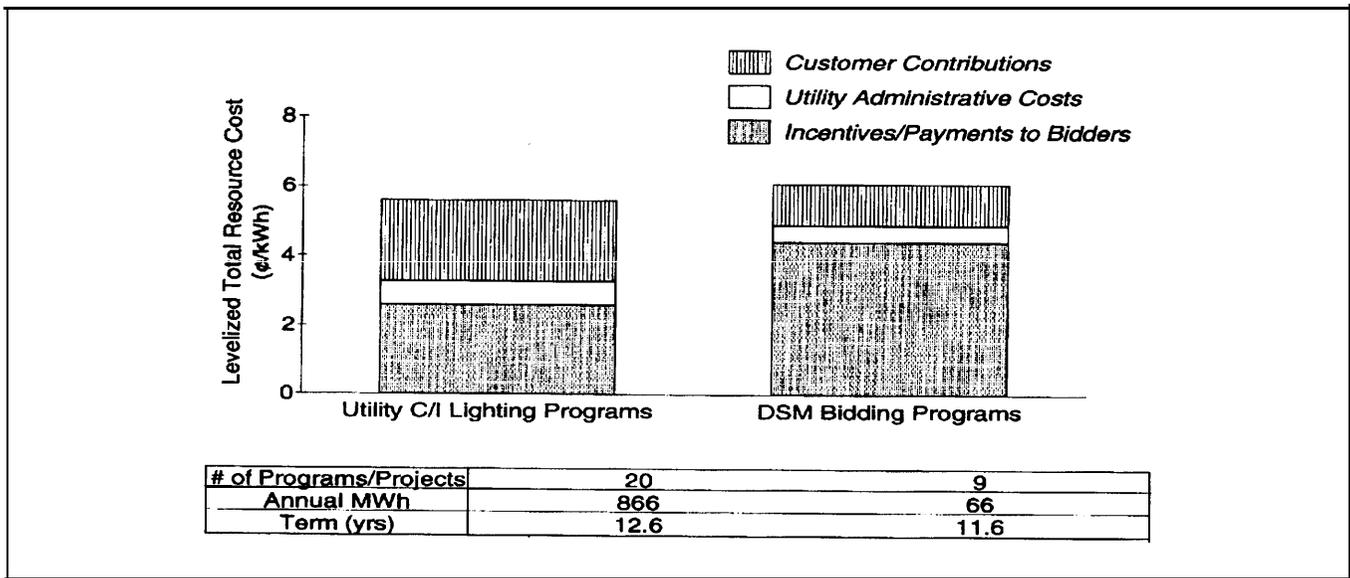
Figure 4. Comparison of Utility C/I Lighting Programs with Bidding Programs for Lighting Measures

savings and risk payment reduction and/or penalties for underdeliveries. In terms of data limitations, there are similar cost accounting issues (e.g., treatment of administrative costs and relatively poor information on customer costs) for both bidding projects and C/I lighting programs in the DEEP study. This analysis should be viewed as exploratory, primarily because there is very limited overlap of utilities in both samples and because it is unclear that similar services (or products in some cases) are being offered by each type of program.

Value of DSM Bidding Programs

In this section, we comment briefly on the economic resource valuation of these DSM bidding programs. Ultimately, the merits of DSM bidding will be judged on whether the process yields projects that offer economic benefits to ratepayers compared to the relevant alternatives. In this regard, the costs of a "comparable" utility DSM program adjusted for additional risks and services provided by a DSM bidder provides a lower bound for comparing economic benefits to ratepayers of DSM projects, while the utility's avoided supply costs provides an upper bound. Detailed case studies of individual utilities would be required in order to define DSM programs that are "comparable" to DSM bids in terms of measures installed, services provided, performance risk, and customer satisfaction (Freeman Research Associates 1989).

In our sample of bidding programs, total resource costs range from 42 - 104% of the utility's avoided supply costs as published in the bidding RFP or used during bid evaluation (see Table 2).[11] However, given the uncertainties in customer and utility administrative costs and future avoided costs, several of these initial bidding programs

appear to be only marginally cost-effective from this societal perspective. For example, estimates of future avoided costs have decreased significantly at many of these utilities since the early 1990s primarily because of lower forecasts of future gas prices and reduced need for new capacity.

Suggestions on DSM Bidding Program Design

Based on our review of utility experiences with DSM bidding, we would offer the following suggestions:

Separate RFPs for DSM Resources Are Preferable

For both theoretical and practical reasons, we prefer separate solicitations for supply-side and DSM resources. Supply-side and DSM resources differ significantly in terms of market structure, inherent characteristics, and level of development. In addition, our results suggest that bid payments were higher for those utilities that issued integrated supply-and DSM solicitations compared to those utilities that used either separate RFPs for DSM resources or parallel RFPs for supply and DSM.

Economic Valuation of DSM Bids

Determining the appropriate economic benchmark to use in valuing DSM bids is complicated by the fact that utilities are often trying to reconcile conflicting objectives with respect to DSM resources (e.g., maximize economic benefits to society, limit short-term rate impacts). In a DSM-only bidding program, we would suggest using the

TRC test as a threshold requirement, primarily because the TRC test often leads to perverse results in a DSM bidding context. 12 We prefer bid evaluation approaches that focus on costs or value to the utility. Scoring options can be either objective (e.g., Utility Cost Test), subjective (e.g., rank bids based on measures of value to utility) or incorporated in program design (e.g., set ceiling prices that are linked to utility DSM program costs in aggregate or for individual measures). Overall, these approaches will tend to encourage DSM developers to obtain maximum cost contributions from host customers. We expect this to become an even more prominent design feature of DSM programs as utilities respond to increasing competitive pressures by attempting to structure DSM programs so as to minimize rate impacts.

Encouraging DSM Developers to Propose and Install Comprehensive Packages of Measures

For some utilities, the degree of comprehensiveness of services and measures offered by DSM developers is an important element in assessing bid quality. However, our analysis indicates that utilities frequently have difficulty crafting enforceable contract provisions to ensure that DSM developers actually install comprehensive packages of measures in the commercial sector. A utility's bid evaluation and scoring system can encourage DSM developers to propose comprehensive retrofits by assigning a significant weight to a comprehensiveness attribute or by specifying as a threshold requirement the maximum savings amount that can be obtained from a particular end use (e.g., no more than 70% of savings from lighting measures).

In terms of enforcing representations made by DSM bidders in their proposals, utilities can include provisions that limit their obligation to make payments if savings from a particular end use (e.g., lighting) exceed a specified percent of the total contract capacity (e.g., 70%). Another attractive option is to negotiate various types of tiered pricing schemes in which a DSM developer would receive a higher bid payment if they achieve additional savings reductions above a pre-specified amount (either at the end use or whole-building level). The level of bid payments could also be linked to the mix of measures achieved.

Acknowledgements

Endnotes

1. Levelized total resource costs provides an indication of the cost of each kWh saved with costs recovered in equal payments over the economic lifetime of the measure at an interest rate equal to the utility's discount rate.

2. For example, in New York, New Jersey, and California, bidding RFPs were designed over several years in litigated regulatory processes. Utilities in other states (e.g., Colorado, Indiana, and North Carolina) developed and issued their RFPs without any formal regulatory approval upfront. For bidding programs that included both supply and DSM resources, it would have been necessary to develop a method to allocate administrative costs between both resources.

3. Consolidated Edison provided estimates of annual hours of operation for its contracts. For the Orange & Rockland projects, we used a lighting schedule for commercial facilities in New York based on contract analyses prepared by the utility. The LILCO contracts had two years of operating data. Public Service of Colorado was unable to provide data on estimated hours of operation for individual measures; thus, we made a conservative estimate of minimum hours of operation for all measures in aggregate over an assumed 15-year contract term.

4. For the one utility where contract terms were obviously much less than estimated equipment measure life, we calculate total resource costs based on a range of economic lifetimes (i.e., contract term and equipment measure lifetime).

5. Adjusting for "end effects" would involve adjustments to shorter term projects because presumably the utility would have to purchase power in order to meet additional demand over a standardized planning horizon. Long-run avoided costs were not readily available for all utilities.

6. LILCO set ceiling price of $250/kW for low-cost lighting measures and $500/kW for high-cost measures. ConEd's ceiling prices ranged from $725/kW for relamping fluorescent fixtures to $ 1,900/kW for replacing fluorescent fixtures.

7. "Lost opportunities" occur when measures that can be installed cost-effectively are not offered to customers. Lost opportunity measures are either not cost-effective to install later as single measures or are too difficult to sell to customers at a later date

because the customer prefers to make all energy efficiency decisions during the initial retrofit (PG&E 1992).

8. Success rate is defined as the ratio of the MWs accepted from DSM bidders compared to MWs initially proposed by DSM bidders.

9. For example, in many integrated bidding programs, utilities relied solely on the equivalent of the Total Resource Cost test in scoring the economic attributes of projects. The TRC test does not differentiate between costs paid for by the customer vs. costs paid by the utility because it focuses only on total costs.

10. Some utilities would argue that ESCOs are able to target their efforts to particularly cost-effective market segments (e.g., buildings with high hours of operation), whereas most utility programs are open to all C/I customers. Thus, a utility's costs to acquire DSM resources from these customers would be lower than their typical program average (Hamilton and Flaim 1992).

11. The avoided supply costs for individual projects typically vary among utilities because of differences in the load shape and load factor. We typically calculated project-specific, avoided costs, which were then aggregated to the utility program level using the same procedure used to calculate total resource costs (i.e., weighting avoided costs by kWh savings of individual contracts).

12. DSM bidders tend to maximize payments from the utility and not host customers when the TRC test is used as the economic scoring attribute. We would place more emphasis on societal net benefits (normalized for project size) to select among supply and DSM projects if utilities are required to conduct integrated bidding.

References

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