San Francisco Distributed Energy Resources Testbed

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ABSTRACT

This paper reports the results of a two-year research effort to implement and evaluate the impacts of energy efficiency (EE), demand-response (DR) and distributed generation (DG) measures – collectively termed “distributed energy resources” (DER) -- in Southeast San Francisco. The study focused specifically on two distribution feeders: a “private-sector” feeder serving a mix of less than 200 kilowatt (kW) commercial customers, predominantly refrigerated warehouses; and a “public-sector” feeder serving a publicly-owned sewage treatment plant with a 1.95 MW cogeneration facility and 255 kW solar array.

The research, which was funded by the California Energy Commission (CEC) Public Interest Energy Research (PIER) program, in collaboration with Pacific Gas and Electric Company (PG&E) and San Francisco Public Utility Commission (SFPUC), examined the factors influencing customer adoption of DER measures; the energy and cost savings achieved; and load impacts on the two feeders.

The research found that small- and medium-sized commercial customers, who are generally underserved by existing utility and public sector DER programs, can be effectively recruited into DER programs through a community-based approach. In addition, the research demonstrated that small-scale pilot programs can provide the basis for state energy regulators to launch larger beneficial programs.

San Francisco Community Power, a nonprofit community-based organization, packaged various DER measures and persistently approached businesses that had previously not fully participated in municipal- and utility-sponsored DER programs. The measures adopted through this effort resulted in cost-effective electricity use reductions that averaged 13 percent per participating customer. A first-of-its-kind DR program developed specifically for less than 200 kW customers achieved temporary load reductions of 11 percent – consistent with the literature on similar programs catering to larger energy users -- though actual kW reductions were less than anticipated (Barbose 2004). DR implemented at the sewage treatment plant achieved an average reduction of 192 kW per curtailment call, or 5.1% of the normally occurring load. Despite significant DER penetration on both feeders, feeder level impacts were detectable only for the operation of the cogeneration facility at the sewage treatment plant on the public-sector feeder.

The research found that key barriers to commercial customer adoption of DER programs sponsored by vendors, municipalities and utilities include a lack of trust in the asserted cost-savings; poor communication that tended to emphasize measures’ technical attributes as opposed to beneficial outcomes; and a laborious enrollment processes.

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San Francisco Distributed Energy Resources Testbed Study

The San Francisco Distributed Energy Resources (SF DER) Test Bed Study examined the impacts of energy efficiency (EE), demand-response (DR) and distributed generation (DG) – collectively termed "distributed energy resources" (DER) – on ratepayers, the local utility, and the distribution system in Southeast San Francisco. The project was initiated through the identification of a number of DER "clusters," with one private- and one public-sector feeder line ultimately selected for inclusion in the study. These two distribution feeder lines were selected based on their exhibiting four primary characteristics: 1) located within SF Power's service territory; 2) featured a range of existing or potential DER activities; 3) had the potential to meet a minimum threshold of DER penetration, and thereby show feeder level impacts; and 4) collectively reflected a mix of institutional decision-making by including private- and public sector sites.

The private-sector feeder serves a mix of mostly private-sector small- to medium-sized commercial (<200 kW) customers. The line is dominated by 25 wholesale produce warehouses, 13 of which are located at the San Francisco Produce Mart and all of which maintain a least one walk-in refrigerated box. The larger wholesalers have four or more jumbo walk-in refrigerated boxes as well as heated walk-ins that are used for ripening bananas.

The public-sector feeder is a dedicated line serving the SFPUC Southeast Wastewater Treatment Plant (SEP). The SEP operates a 1.95 MW methane fueled cogeneration facility and 255 kW solar array.

Distribution feeder load and customer load and billing data were collected over a two-year period, capturing electricity use patterns before and after implementation of a significant number of DER measures. In the case of the private sector feeder line DER activity consisted predominately of energy efficiency and DR measures. DER activity on the SEP was dominated by its DG facilities and active participation in a DR program. The collected data were analyzed to determine impacts on individual customer and feeder loads.

San Francisco Community Power, a nonprofit organization that helps low-income families and small businesses manage their energy use, led the effort to implement energy efficiency and demand response measures at commercial customer sites. The SFPUC offered access to the SEP as well as associated meter data from the cogeneration and photovoltaic installations. Pacific Gas & Electric (PG&E), the investor-owned utility (IOU) serving Northern California, provided customer billing and interval meter data for each of the study feeders.

DER Implementation in California

Non-residential DER programs offered in California and throughout the United States have typically focused on large commercial or industrial customers. Historically a limited number of energy users that are able to offer significant load reductions have provided the most attractive opportunities for electric utilities and independent system operators (ISO) to target for DER implementation. Large commercial and industrial customers are usually on rate schedules that require interval meters[2], and are more likely to have dedicated facility or energy management personnel, making them accessible to marketing efforts by utilities and others. In

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[2] In California all ratepayers with energy demands in excess of 200 kW have interval meters.

contrast because smaller commercial customers can be hard to reach and have less kW to work with per site, they have been regarded as a less cost-effective population for DER programs.

Demand response programs in particular have overlooked the small- and medium-sized commercial sector. Of the ten programs available in California in 2006, four required that a participant have an average demand of at least 200 kW;[3] two required a commitment of at least 100 kW in demand reduction; and one required the ability to reduce circuit loads by from five to 15 percent. Prior to the SF DER Testbed project the only program that provided financial incentives for smaller commercial customers was the Summer Discount Plan, which offered a remote-activated cycling device for commercial and residential air conditioners.

A Neglected Customer Segment

As energy regulators and utilities look to expand DER programs – as a hedge against electric outages, to reduce system costs, and to lower electricity-related environmental impacts -- they are increasingly looking to small- and medium-sized commercial customers as a neglected source of "negawatts." These ratepayers account for approximately 29 percent of the total load for the three IOU's serving most of California (Energy and Environmental Economics 2006). In San Francisco small- and medium-sized businesses account for an even greater portion of electricity use: the commercial sector (including large commercial) is responsible for 58 percent of total load (City and County of San Francisco 2002).

Prior to the research project no DR programs were available to independent (non-chain) businesses with less than 200 kW of demand. As a result, implementing DR programs on the private-sector feeder required that SF Power gain California Public Utility Commission (CPUC) approval for a pilot project. In 2005 the CPUC adopted a limited pilot program to enroll businesses under 200 kW located in the study area, which it later expanded to five San Francisco Bay Area counties.

Study Area

San Francisco is well situated to take advantage of the economic and technical benefits of an agile energy system that relies on sustainable DER and a cooperative planning and implementation processes (Clark and Bradshaw 2004). The City is located on a transmission-constrained peninsula, and is reliant on local generation to meet peak needs. Moreover, there has been long-term pressure by community groups and policy makers to reduce the use of particularly polluting generating resources, and to increase reliance on environmentally-friendly DER.

In 2002 community groups and civic leaders developed an electricity resource plan that ultimately led to the closure of the Hunter's Point Power Plant in 2006, the likely shuttering of the Potrero Power Plant by 2009 and which emphasized energetic implementation of DER measures (City and County of San Francisco 2002). Under a "moderate" implementation scenario, San Francisco plans to use energy efficiency and load management programs to reduce anticipated "1 in 10" peak loads of 988 MW in 2012 by as much as 80 MW and 27 MW respectively (PG&E 2007). In addition, local DG options could provide up to 150 MW of peak load. Taken together, San Francisco's policies, if effectively implemented, suggest that use of

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[3] The Demand Bidding Program catered to chain businesses in which at least one of the participant's sites had to have peak loads exceeding 200 kW

DER could provide sufficient demand reductions and/or supply increases to meet increased energy demands over the next half-decade or more.

With its mild weather, San Francisco has a relatively flat load profile that tends to peak in the early fall (e.g., September), with a second less pronounced peak in mid-winter (e.g., February). Unlike much of California, there is minimal use of air conditioning. The study feeder loads tend to be dominated by commercial and industrial processes (e.g., refrigeration, storage) that are even less sensitive to weather than loads in other San Francisco neighborhoods.

While these unique factors limit the potential to extrapolate study results to universally applicable findings, they also imply that areas with more variable, weather-determined loads may provide greater opportunities for effective DER implementation, especially related to DR.

Program Administration

SF Power, in collaboration with PG&E, San Francisco Department of the Environment (SFE), and various vendors, implemented a large number of energy efficiency programs at facilities served by the private-sector feeder, including lighting and refrigeration retrofits, and electric appliance replacement and repair programs. In most cases the adopted EE were associated with existing utility and vendor incentives. For example, SF Power collaborated with the EnergySmart Grocer Program to offer food service vendors with a free energy efficiency audit which identified available rebates, retrofit costs, and payback periods, as well as technical assistance in selecting among energy-saving options and implementation strategies. As a result of this EE initiative a number of businesses adopted evaporative fan controllers, cold temperature compact fluorescent light bulbs for walk-in coolers, strip curtain and door gasket retrofits, and "vending misers."

SF Power also created several initiatives, including a program to install timers on pallet jack and fork lift batteries as a way of shifting load off-peak. As part of its marketing campaign SF Power staff attempted to visit all of the facilities on the feeder line at least once, and was ultimately successful in working with 41 individual ratepayers.

The DR measures offered included the Business Energy Coalition (BEC), Demand-Bidding Program (DBP), California Demand Reserves Partnership (DRP), and SF Power's DR program if, as was generally the case, the customer was a non-chain ratepayer with less than 200 kW of demand.[4]

The total potential DER-related load changes anticipated for the private-sector feeder are shown in **Figure 1**. Potential EE measure savings were identified for 24 sites and expected to range from 65 to 125 kW. DG potential at three sites was initially approximated at 31 kW. DR potential at 33 sites was expected to be 73 kW for selected on-peak hours.

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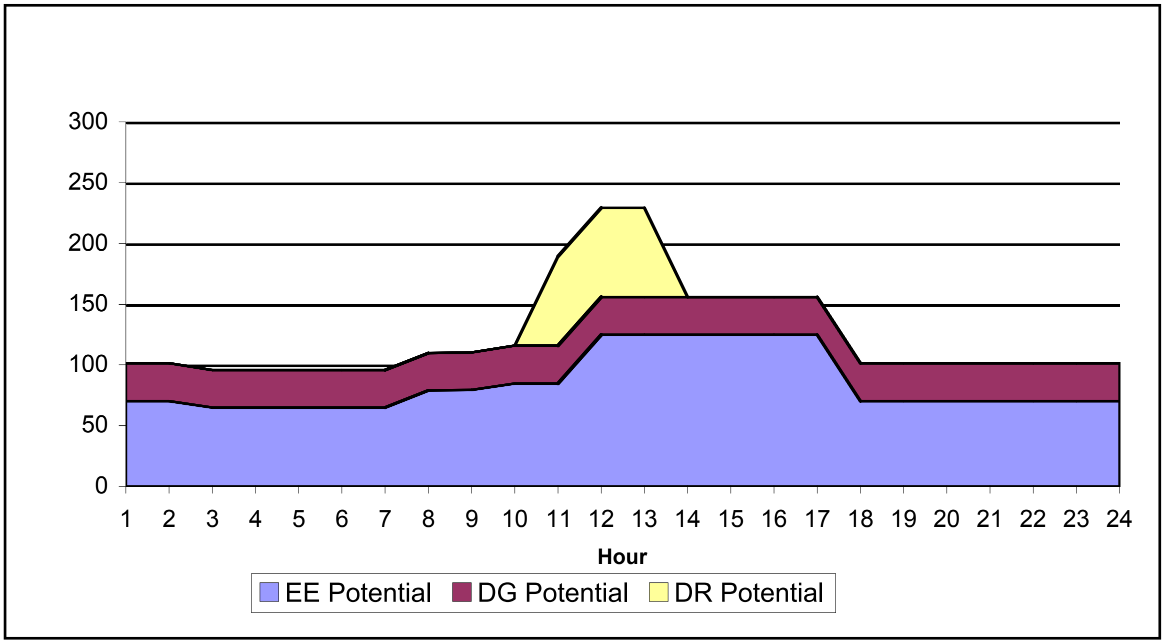
[4] With the exception of the DBP, which offered a minimal payment when a participant voluntarily reduced their electricity use after bidding to do so, all other DR programs essentially provided a monthly "reserve" payment based on the amount of kW a ratepayer was willing to reduce, as well as a small fee for actual reductions. The BEC was the most lucrative program, but it was ultimately limited to customers who could reduce at least 50 kW.

Figure 1: Private-Sector Feeder Anticipated DER Impacts



Results

Energy Efficiency

Energy (kWh) savings. Billing data were collected for all feeder facilities that installed EE measures during the study period. However, only five participants on the private-sector feeder had sufficient billing data for a robust analysis. EE measures at the SEP on the public-sector feeder were phased-in over time in combination with process upgrades. As a result, a specific analysis of EE measures impacts was not possible.

Several regression models were considered and evaluated based on overall R^2 and AIC criteria. The best fit was achieved with a model using the following variables: an EE dummy variable for the periods before and after the installation of EE measures, a trend variable increasing by an increment of one for each billing period, heating degree days (HDD), and cooling degree days (CDD). The Maximum Likelihood Estimators (MLE) for the model coefficients were estimated separately for each billing customer using SAS.

The percentage of electricity consumption customers were able to reduce as a result of the adopted EE measures is shown in **Table 1** which compares the initially-approximated and statistically-estimated energy savings for the five study participants to the average annual energy consumption of the participants prior to their EE installations.[5] This analysis indicates that participating customers were able to reduce their energy use on average by 12.7%.

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[5] Initially-approximated savings estimates for both EE and DR were significantly different from post-implementation statistically-estimated changes. In the case of EE this casts some doubt on deemed savings estimates; in the case of DR it is mostly due to the fact that, absent interval meter data, it is difficult to estimate existing peak loads, as well as to predict how much individual customers are likely to actually reduce their electricity use when called upon.

Table 1: Estimated Energy Reductions from EE as Percentage of Consumption

Customer	Average Annual kWh pre-EE	Initially Approximated Annual kWh Savings	Statistically Estimated Annual kWh Savings	Percent Reduction
1	187,610	-9,508	-8,943	-4.8%
2	193,395	-1,460	-26,689	-13.8%
3	173,163	-55,673	-36,843	-21.3%
4	28,926	-1,344	-431	-1.5%
5	26,722	-2,920	-4,537	-17.0%
Total	609,816	-70,905	-77,442	-12.7%

Cost savings. Overall, the EE measures installed on the private-sector feeder were highly cost-effective from all perspectives, as shown in Table 2.[6]

Table 2: Benefit Cost Results for EE Measures Implemented on Private-Sector Feeder

Cost Test	Total kWh Saved	Benefits	Costs	Net Benefits	Benefit/Cost Ratio
Participant (PCT)	8,714,971	$1,459,016	$ 29,637	$1,429,379	49.23
Program Administrator (PAC)	8,658,660	$753,157	$ 39,209	$713,949	19.21
Total Resources (TRC)	8,658,660	$753,157	$ 82,245	$670,913	9.16

Demand Response

Capacity (kW) savings. DR-induced load changes were estimated based on pre- and post-curtailment call data, which were used to calculate the 'baseline' load and compute the difference between the measured load and the 'baseline' (C.K Woo. 2006). The linear regression includes a weather variable and dummy variables for each hour of the day, day of the week, and demand response event. Note that this definition of impact is different than that used to establish customer performance under the various DR programs, and thus is not a measure of performance under specific DR program payment rules.

Load impact estimates, as well as their upper and lower 95 percent confidence limits, for the private sector feeder line are displayed in tabular form in **Table 3**. On average the six participants curtailed 2.5 kW over the four two-hour curtailment intervals; an 11 percent reduction from normally occurring peak loads. The upper and lower bounds for the average response are 3 kW (13.3 percent) and 2 kW (8.0 percent). As indicated in the table, there was a consistently higher load impact in the second hour of each event: the average load reduction for the second hour was 3.63 kW, or 46 percent greater than the 2.5 kW average impact for both hours of each event. The mean statistically estimated impact of 2.5 kW was considerably less than the 43 kW expected by the six metered customers. The actual response as a percentage of

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[6] The benefit-cost results presented below are based on deemed savings for all program participants on the private-sector feeder. Assumptions regarding the useful life and net to gross ratio of EE measures were based on similar measures from the California Database of Energy Efficient Resources (DEER). The avoided cost of energy saved was calculated using CPUC adopted avoided cost forecasts (R. 04-04-025)

enrolled kW was much smaller than 80 percent response rate experienced by California investor owned utility DR programs in the Summer of 2006 (CPUC 2007).

Table 3: Aggregate DR Response Estimates for All Six Metered Participants on Private Sector Feeder

Date	Hours	Impact estimate (kW)	Upper 95% confidence limit	Lower 95% confidence limit
April 5	10:00-11:00	0.13	-1.27	1.53
April 5	11:00-12:00	-3.13	-4.45	-1.81
April 13	14:00-15:00	-0.65	-2.07	0.77
April 13	15:00-16:00	-2.29	-3.43	-1.15
April 20	11:00-12:00	-1.70	-3.02	-0.38
April 20	12:00-13:00	-4.04	-5.44	-2.64
April 26	16:00-17:00	-3.12	-4.25	-1.99
April 26	17:00-18:00	-5.07	-6.47	-3.67
Average		-2.48	-3.11	-1.86

The SEP was one of five SPFUC facilities providing a total of 1 MW of curtailable load enrolled in the DRP. Load impact estimates, as well as their upper and lower 95 percent confidence limits, were calculated for each of the 14 days on which the SEP was called to curtail. The average load impact estimate for the actual event hours was an increase of 46 kW, or 1.2 percent increase, from normally occurring peak loads. The upper and lower bounds for the average response are an 11 kW decrease (0.3 percent) and a 103 kW increase (2.8 percent) in normally occurring load.

While loads increased slightly during the curtailment period, the maximum demand reduction from the SEP plant appeared to occur two to three hours prior to the event hours. According to the plant operator, this early response was primarily due to the fact that DRP-induced reductions at the SEP involved adjusting several different motors and systems, making it difficult to obtain a consistent load drop. The SEP also generally experienced a slight increase in load after the initial reduction once the plant returned to steady state operation. As a result of these challenges, SEP staff curtailed prior to the scheduled reduction period as a strategy to meet their targets. Although this approach did not result in the achievement of the hoped for load reductions during the called-for curtailment period, it did enable the SEP to receive payments under the DRP program. That's because DRP payments for load reductions were not based on real-time load drops, but rather the difference between actual load and the 10-year previous day rolling average for the curtailment hours.

Table 4 displays the average estimated load impact two to three hours prior to the curtailment period when the maximum demand reduction occurred. The average demand reduction over the 14 event dates during these pre-event hours was 193 kW, or 5.1 percent of the normally occurring load. The upper and lower bounds for the average demand reduction were a 242 kW decrease (6.4 percent) and a 144 kW decrease (3.8 percent).

Table 4: Public-Sector DR Response Estimates

	Enrolled kW	Impact Estimate (kW)	Upper 95% confidence limit	Lower 95% confidence limit
kW	200	193	242	144

Cost savings. The primary benefits resulting from demand response programs are on-peak, immediate energy savings and improved system reliability. DR programs reduce the risks to utilities, customers, and society of tight supply/demand balances, high prices, and, in worst-case scenarios, involuntary outages.

The primary DR program benefits from the PAC and TRC perspectives consist of peak capacity and energy-related cost savings, avoided transmission and distribution (T&D) expenditures and reliability improvements. The value of a particular DR program depends on how reliably it can deliver load reductions in a given time period, as well as the length and frequency of the periods during which the utility may call for a curtailment.

From the participants' perspective, DR benefits include program payments or incentives; lower overall electricity use arising both from the temporary reductions and from the energy management "conditioning" induced by program participation; and enhancements in area reliability, with concomitant reductions in the risk of forced outages. In the test DR program, participants were given modest incentive payments ranging from $20 to $50 dollars for all four curtailment calls.

The $/kW and average $/MWh value of the test program employed on the Produce Mart feeder can be seen in **Table 5**. These values are based on the number of hours during which load could be curtailed and market prices forecasted for those hours (Brian Horii 2006). The benefits in the first row are based on energy market price forecasts alone. The second row shows the program benefits including potential T&D savings.

Table 5: DR Value from SF DER Test Program

Program	Energy Only		Energy, T&D	
	$/kW Value	Average $/MWh	$/kW Value	Average $/MWh
SF DER Test Program	$8.33	$260.20	$15.90	$496.81
Demand Reserves Partnership	$38.90	$255.94	$71.16	$468.13

Table 6 illustrates the range of potential program benefits. To calculate the overall monetary value of the DR test program from the PAC and TRC perspectives, the team combined the value of the curtailed energy with the program's enrolled and statistically-estimated demand reductions.

Table 6: Enrolled and Statistically Estimated Impacts from Test DR Program

Program	Units	Enrolled	Statistically estimated Impact	Confidence Limit on Statistically estimated Impact:	
				Lower 95%	Upper 95%
SF DER Test Program Value	kW	39.1	2.5	1.9	3.1
	Value	$621	$39	$30	$49
Demand Reserves Partnership	kW	200	193	242	144
	Value	$14,232	$13,725	$17,211	$10,238

For comparison purposes, the estimated cost to commercial customers of a forced complete outage is assumed to be $68.20 per kWh un-served, based on value of service studies

(PG&E 2000). Therefore a small business with 3 kW of demand could lose an estimated $613.80 as a result of a three-hour outage. This is significantly higher than the voluntary payments participants were willing to accept to curtail a portion of their load.

Load Shifting

Energy (kWh) shifted. SF Power determined that 320 battery-powered pallet jacks or forklifts were used at businesses located on the SF Wholesale Produce Mart feeder line. Food wholesalers typically recharged pallet jack/forklift batteries starting in the mid- to late-morning, while other energy users on the line tended to do so in the early-afternoon. The battery discharges tend to average 75 percent, and require 1.25 kW for approximately 8 hours to fully recharge.

SF Power evaluated a number of timers that could shift the pallet jack re-charging to off-peak hours and selected a model reliable enough to meet the demands of heavy duty commercial operations. Ultimately 43 timers were installed at Produce Mart feeder line businesses, shifting 54 kW of demand from on- to mid- or off-peak hours.

Cost savings. Total annual energy use is not impacted by the timer-based load-shifting program. Instead, from the PAC and TRC perspective the benefits consist of avoiding the higher energy prices during mid- and on-peak hours in favor of lower prices offered during off-peak hours. From the participant's perspective the potential benefit from load-shifting programs is the savings achieved by shifting load to a time of use (TOU) period with a lower retail rate.

Savings for the PAC and TRC are calculated as previously described for energy efficiency measures, using hourly avoided cost forecasts. All program participants were assumed to be on a PG&E commercial TOU rate (A-10). This resulted in savings to the customer of $133 per kW shifted. Equipment and administrative costs for the timer were $20 and $8 respectively. The B/C test results for the demand-shifting program are detailed in **Table 7**.

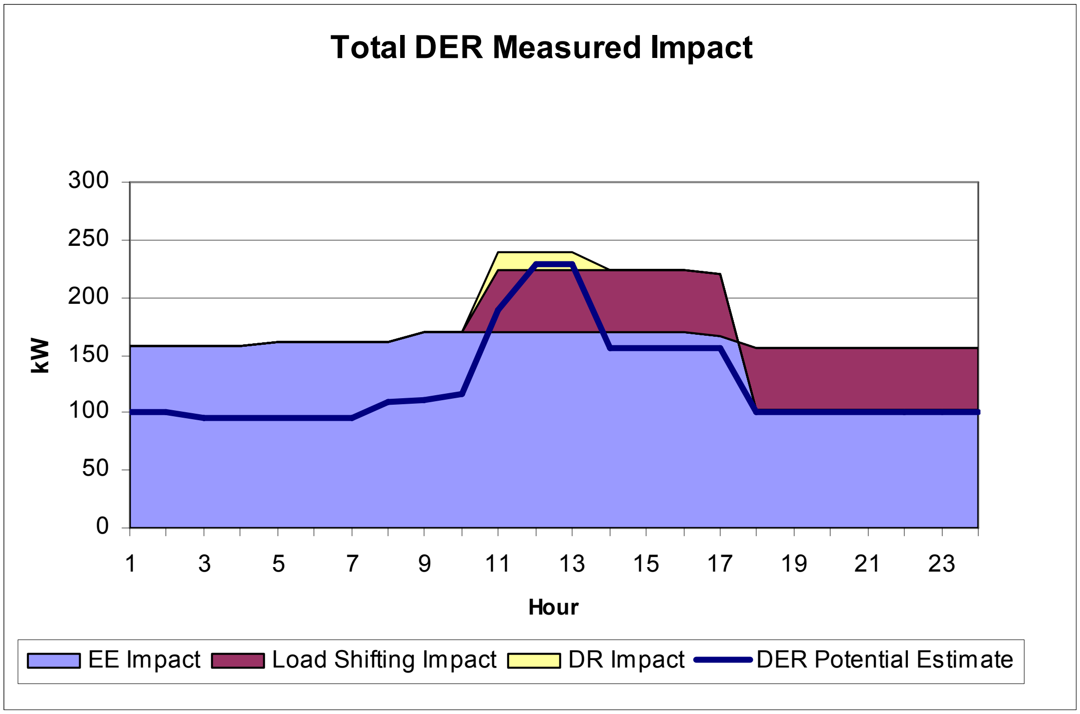
Table 7: Benefit Cost Results for Timer-Based Load Shifting Initiative

Cost Test	Benefits	Costs	Net Benefits	Benefit/Cost Ratio
Participant (PCT)	$8,008	$0	$8,008	n/a
Program Administrator (PAC)	$1,324	$1,204	$120	1.10
Total Resources (TRC)	$1,324	$344	$980	3.84

Total Private Sector Feeder DER Impact

A comparison of the anticipated and measured DER impacts for the private-sector feeder is shown in **Figure 2**. The EE impacts were somewhat higher than initially estimated while the DR impacts were significantly lower. For a variety of reasons, the three initially identified DG sites turned out not to be viable. On the other hand, the pallet jack timer load shifting measures were developed during program implementation and were not included in the initial estimate. In total, the estimated energy savings during peak hours totaled 240 kW, approximately 104 percent of the total initial estimate of 229 kW.

Figure 2: Private-Sector Feeder Anticipated and Actual DER Impacts



In general, technology-driven applications, such as industrial timers for load shifting and installed EE technology, worked most predictably. Customer-driven DR measures, on the other hand, performed less predictably. While some participants implemented the same load reduction tactics every time they were called, others were less consistent, or did not respond at all. Some customers, particularly restaurants and retail shops, had limited capacity to reduce their load, even in cases where they were willing to participate in a DR program. Although three wholesalers indicated that they would temporarily shut-off refrigeration or freezer compressors, none actually did so when called upon. In the end, few facilities were willing to temporarily reduce anything other than lighting. This experience suggests that more work needs to be done to develop trustworthy educational materials transparently detailing effective load reduction strategies for such applications as refrigeration. Likewise, technology-enabling automatic curtailment responses may be necessary to obtain consistent load reductions.

Conclusion

Barriers to Implementation

Without a focused effort it is unlikely that small- and medium-sized businesses will widely adopt DER measures. This is evidenced by the fact that, despite several years of concerted efforts and substantial subsidies sponsored by the City and County of San Francisco, PG&E, and vendors, a significant number of businesses located on the private sector feeder line had not completed even basic energy efficiency lighting retrofits. Likewise, a previous San

Francisco funded effort to replace inefficient refrigeration identified a large number of decades-old, inefficient, commercial refrigerators in the same area.

DER marketing efforts frequently suffer from a lack of transparent, trustworthy information. Vendors often focus on promoting the technology offered with little regard to actual implementation in a business setting. Utility DR programs can involve a complicated and time-consuming enrollment process. Without a dedicated energy management staff small- and medium-sized energy users have a limited capacity to evaluate complex DER programs.

DER efforts also suffer from a tendency to focus on individual technologies or specific programs rather than on providing comprehensive energy management services to businesses. Utility and municipal programs usually offer a limited number of incentives to broadly defined customer segments. Such efforts strand potential savings that could be identified by a more comprehensive review of individual businesses, and they have the potential to alienate business owners, who simply want the bundle of DER that best matches their needs.

Results of a Focused DER Implementation Effort

The study effort demonstrated that EE and DR savings -- of 13 and 11 percent respectively – could be cost-effectively achieved from small- and medium-sized energy users. However, despite implementing DER measures that equaled approximately three percent of total feeder load, impacts were not detectable at the feeder line level. This suggests that greater penetration is needed to achieve feeder level impacts, something that is potentially achievable on feeder lines with more diverse energy demands, including air conditioning.

The research demonstrated that community-based organizations, such as SF Power, can effectively recruit commercial class ratepayers to adopt DER programs, with concomitant benefits. These results in large part were achieved by a persistent and sustained customer contact, which enabled the development of ongoing customer relationships over a multi-year time period. With some notable exceptions, SF Power initially encountered either a lack of interest or outright hostility from businesses. It took multiple visits at the appropriate hours to convince many of the facilities to even consider adopting the offered energy efficiency measures. Many of the businesses (rightfully) viewed the initially-approximated savings potential of individual measures with skepticism. However, after achieving early successes and working with feeder line businesses for more than a year, participants increasingly relied upon SF Power to vet technologies and programs and to recommend additional DER measures. With in-depth knowledge of customer characteristics and energy needs, SF Power staff was able to recommend a suite of measures best suited to individual businesses. Further, SF Power was viewed by customers as an independent and reliable information source regarding DER programs.

The study project's pilot-oriented test-bed approach resulted in the creation of several innovative DER approaches, including the development of new DR tariffs for small- and medium-sized businesses; the electric forklift/pallet jack load-shifting initiative; a lighting retrofit program for small churches; and the identification of commercial refrigeration as a key area for both additional efficiency and DR efforts.

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