Small Business Super Saver Program Hours Of Operation Study

Study ID: SDG0221

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1.   Introduction

San Diego Gas & Electric Company (SDG&E) began implementing the Small Business Super Saver Program in early 2006.   The program has been successful in encouraging the adoption of energy efficient measures in the small business sector. In April 2006, the Small Business Energy Efficiency Program Evaluation, ID #1340-04 was completed. The evaluation found a discrepancy between the lighting run hours used in the program assumptions (from DEER) and the actual hours found in the study, thus affecting the savings achieved. In addition, the study hypothesized that, for small businesses, customer reported hours of operation of lighting equipment are accurate.

In May 2006 SDG&E revised the rebate levels for the program and established three tiers based on run hours with different rebate levels for each tier.

SDG&E requested and received the Energy Division's approval of study that would test the hypothesis that customer reported hours of operation are accurate and/or reliable. This study was funded through the public goods charge (PGC) for energy efficiency and is available for download at www.calmac.org.

2. Approach

The approach employed was to install light loggers on a sample of Small Business Super Saver Program participants and gather customer interview data on lighting usage patterns. The loggers were installed a minimum of two weeks. The loggers were then removed and data downloaded, cleaned and managed. Weights for the loggers within the facility were developed based on the number of fixtures represented by the logger. The data were annualized for each facility.

The following provides a description of the data collection and analysis tasks.

2.1 Sample

SDG&E identified the sample design based on recent participants of the Small Business Super Saver Program as shown in Table 1.

Table 1
Sample

Tier	Range of Annual Operating Hours	Typical Business Type	# Program Participants	Sample Size
1	≥ 3,400 hours	retail, fast food restaurants, liquor stores, grocery, and gyms	824	25
2	2,400 to 3,400 hours	hair salons, high-end restaurants, and some retail	20	10
3	< 2,400 hours	office buildings, dentist offices, and insurance offices	1,012	25

SDG&E provided the frame of program participants from which the sample was drawn.

2.2 Data Collection

Each study participants was visited by KSI. The project was introduced to the site contact. We experienced a very low rejection rate, with two (2) sites refusing to participate in the study. A brief survey was administered to gather information on how the lights are used within the facility. In addition an inventory of fixtures was made and an assessment on how the lighting was controlled.

The following provides a summary of site activities:

- visit the site,

- introduce the project to the customer,

- conduct a brief survey regarding the operations and operating hours for lighting fixtures,

- count fixtures and identify how lights are controlled,

- determine appropriate monitoring strategy and install light loggers,

- remove loggers after approximately two to three weeks, and

- provide customer contact with a gift card.

The following tasks were performed to manage and analyze the data:

- download and manage the logger and data,

- tabulate survey data,

- analyze the data and report the findings regarding lighting hours of operation and customer reported hours, and

- assess the accuracy of tier assignments based on reported hours compared to measured.

The survey for operating hours, included in Attachment 1, was based on the Small Business Super Saver operating hours worksheet shown in **Figure 1**.

The following terminology will be used through the remainder of this report:

- **Reported Hours**: Annual operating hours estimated using the customer reported schedule, including holidays and vacations, if reported.

- **Measured Hours**: Annual operating hours estimated by annualizing logger data.

The reported hours were compared to measured hours through the ratio of Reported hours to Measured Hours as shown in Equation 1.

Equation 1 $$\text{Ratio} = \frac{\text{Reported Hours}}{\text{Measured Hours}}$$

The data extract provided by SDG&E contained a value for the Tier (1, 2 or 3 for higher to lower operating hours, respectively). The accuracy of the categorization using reported hours was made by comparing reported hours and measured hours. It was assumed that the measured hours yielded the correct tier.

Figure 1
SDG&E Small Business Super Saver Operating Hours Worksheet

SDG&E Small Business Super Saver
Annual Operating Hours / TIER Worksheet

Account Number _____
Customer Name _____
Project TIER _____

Annual Operating Hours	TIER	*Use Annual Operating Hours (Line K) to Determine Tier*
> 3400 hours	**I**	
> 2400 hours	**II**	
< 2400 hours	**III**	

	Day	Hours Open			Total	
Example:						
	Monday	*9 am*	*to*	*5 pm*	*8 hrs*	
	Monday	_____	to	_____	= _____	(A)
	Tuesday	_____	to	_____	= _____	(B)
	Wednesday	_____	to	_____	= _____	(C)
	Thursday	_____	to	_____	= _____	(D)
	Friday	_____	to	_____	= _____	(E)
	Saturday	_____	to	_____	= _____	(F)
	Sunday	_____	to	_____	= _____	(G)
Weekly Total					= _____	(H) (Add Lines A through G)
Average Hours per Day					= _____	(I) (Line H / 7 days=average hours per day)
Work Days per Year					= _____	(J) (Total Work Days per Year. (AA)
Annual Operating Hours					_____	(K) (Line I x Line J)

Work Days Per Year Worksheet
(Check off days the business is closed and add the number of days closed in Line Y)

☐	(L)	New Years Day
☐	(M)	Martin Luther King
☐	(N)	Presidents Day
☐	(O)	Easter Sunday *
☐	(P)	Memorial Day
☐	(Q)	Independence Day
☐	(R)	Labor Day
☐	(S)	Veterans Day
☐	(T)	Thanksgiving Day
☐	(U)	Thanksgiving Day After
☐	(V)	Christmas Eve
☐	(W)	Christmas Day
☐	(X)	**Plus additional days closed per year**
☐	(Y)	**Total Days Closed per Year (Add Lines L through Y)**
365	(Z)	**Days per Year**
☐	(AA)	**Total Work Days per Year**

3.   Results

The reported hours were compared to the measured hours by examining the ratio of reported to measured hours. Table 2 shows a summary of the means of these ratios for the entire sample and each of the tiers. Overall the reported hours were five percent lower than the measured hours. Similarly, for each tier the reported hours were between five and six percent less than measured hours. The confidence intervals indicate that there is some systematic bias that makes the reported different from the reported at the 90% and 95% levels of confidence.

Table 2
Summary of Ratio of Customer Reported Hours to Measured Hours

	Overall	Tier 1	Tier 2	Tier 3
n	60	25	10	25
Mean	0.9492	0.9473	0.9842	0.9372
Std Dev.	0.1186	0.1138	0.1260	0.1225
90% CI	0.0252	0.0374	0.0655	0.0403
95% CI	0.0300	0.0446	0.0781	0.0480

The categorization of the sites to tiers was made from two perspectives. The first was the tier included on the database extract provided by SDG&E. The second was the categorization based on reported hours. The parameter used to determine the "correct" tier was the measured hours. Table 3 shows that only 50 percent were correctly categorized on the tracking database extract. Of the three tiers, Tier 3 had the lowest fraction correct, 36 percent.

Table 3
Summary of Categorization
Based on Tier Assignment From Tracking System

	Overall	Tier 1	Tier 2	Tier 3
n	60	25	10	25
Correctly Categorized	30	15	6	9
% Correctly Categorized	50.0%	60.0%	60.0%	36.0%

The accuracy of tier categorization based on reported hours was assessed. Table 4 shows that the tier assignment accuracy reported hours was more accurate than the tracking database extract, with 16 (27%) projects incorrectly categorized, compared with 50% incorrectly categorized using the database extract tiers.

Table 4
Summary of Categorization
Based on Reported Hours and Confirmed by Measured Hours

Correctly Categorized	Freq.
Yes	44
No	16

The 16 mis-categorized projects were examined by reviewing the magnitude of the difference between the reported and measured hours for each project. This difference was divided by the measured hours to give %-Delta Hours. Table 5 shows that for seven (44%) of the 16 projects the difference between the reported and measured hours was relatively small, less than 10 percent. Three (19%) projects had errors between 15 and 19.9 percent, while six (38%) had deltas greater than 20 percent.

Table 5
Margin of Error (Reported-Measured Hours) of Categorization Based on Reported Hours

%-Delta Hours (Delta/Meas)	Freq.	%	Cum-%
<5%	3	19%	19%
5% to 9.9%	4	25%	44%
10% to 14.9%	0	0%	44%
15% to 19.9%	3	19%	63%
20% to 29.9%	4	25%	88%
30% to 40%	2	13%	100%
Total	**16**	**100%**	

The deviation from the tier boundaries was assessed. The absolute value of the difference (delta) between the reported hours and the nearest appropriate tier boundary was used in this assessment. Table 6 shows the distribution of the deltas by % of the hours of the tier boundary. Thirteen projects (81%) were within 10 percent of the tier boundary. The average absolute delta (the average of the absolute value of delta) was 179 hours.

Table 6
Reported Hours from Tier Boundary

%-Delta Hours (Delta/Boundary)	Freq.	%	Cum-%
<5%	7	44%	44%
5% to 9.9%	6	38%	81%
10% to 14.9%	2	13%	94%
15% to 19.9%	1	6%	100%
20% to 29.9%	0	0%	100%
30% to 40%	0	0%	100%
Total	**16**	**100%**	

Average reported and measured hours and a summary of results by building type are provided in Table 7. The average reported hours varies among the building types. Of the building types identified, warehouse facilities experienced the greatest discrepancy between reported hours and measured hours, with average reported hours sixteen percent lower than average measured hours.

Table 7
Summary of Results By Building Type

	Overall	All Other	Assembly	Grocery	Healthcare	Office	Process	Restaurant	Retail	School	Warehouse
Average Reported Hours	3,031	2,815	3,031	5,123	2,359	2,438	2,766	4,063	3,357	2,550	2,583
Average Measured Hours	3,220	2,804	2,981	5,058	2,504	2,698	2,895	4,305	3,640	2,796	3,250
n	60	9	2	4	5	12	8	5	10	1	4
Mean	0.95	1.01	1.01	1.02	0.94	0.91	0.98	0.93	0.93	0.91	0.84
Standard Deviation	0.1186	0.0725	0.0440	0.1276	0.1779	0.0940	0.1409	0.0988	0.0869	n/a	0.2069
90% CI	0.0252	0.0397	0.0229	0.0420	0.0585	0.0309	0.0464	0.0325	0.0286	n/a	0.0681
95% CI	0.0300	0.0284	0.0273	0.0500	0.0698	0.0368	0.0552	0.0387	0.0341	n/a	0.0811

4.   Conclusions

Following are conclusions based on the results:

- Reported hours is a good approximation for measured hours:

    o Reported hours are approximately 95 percent of measured hours.

- Reported hours are better predictor for tier than the method used in the tracking database extract:

    o Reported hours predict the correct tier in 73 percent of the projects compared with 50 percent of the projects in the tracking system extract;

    o Of the 27 percent with incorrect predicted tier, four out of five projects had hours that were within 10 percent of the tier boundary, indicating the reported for most of those with incorrectly predicted tiers were close to the tier boundary.

5. Attachment 1

Figure 2
Survey for Operating Hours

Tier		Contact Name:	
Site_Nbr		Position:	
Site Name		Business Card:	[Y] [N]
Address			
		Install Date	
City, Zip		Remove Date	

1. What is your operating schedule:

    Monday _____ to _____

    Tuesday _____ to _____

    Wednesday _____ to _____

    Thursday _____ to _____

    Friday _____ to _____

    Saturday _____ to _____

    Sunday _____ to _____

    Holidays _____ to _____   **No. of Holidays** _____

  Vacations (describe):

2. Number of shifts *(circle one)*:   **[n/a]**   **[1 shift] [2 shifts]**   **[3 shifts]**

3. Generally, how are your lights controlled? *(circle all that apply, explain)*

    a. Switches

    b. Timeclocks

    c. EMS

    d. Other (describe):

4. Areas lighting is located and quantity of lighting.

No.	Logger ID #	Logger Location	Fixture Type	Controls	# Fixtures	Install Time	Remove Time
1				Switch / Panel / Timer / Occ Sens			
2				Switch / Panel / Timer / Occ Sens			
3				Switch / Panel / Timer / Occ Sens			
4				Switch / Panel / Timer / Occ Sens			
5				Switch / Panel / Timer / Occ Sens			
6				Switch / Panel / Timer / Occ Sens			
7				Switch / Panel / Timer / Occ Sens			
8				Switch / Panel / Timer / Occ Sens			