On-Site Validation of Commercial, Industrial and Agricultural Customized Financial Incentive Programs

Anne Gumerlock Lee, William C. Miller and Susan M. Buller, Pacific Gas and Electric Company
Taghi Alareza and Jeff Johnson, ADM Associates, Inc.

Introduction

The commercial, industrial and agricultural (CIA) Customized Financial Incentives Programs were designed by PG&E to reduce demand and electricity costs. The programs are designed to give financial incentives up to $300,000 to CIA customers who undertake large or complex projects retrofitting equipment which significantly reduce their consumption of electricity or gas. Incentives are paid at the rate of $0.06 per kWh of first-year saved energy and $0.20 per therm of first-year saved gas, not to exceed $300,000 or 50% of the direct project cost.

On-site surveys were conducted at 50 to 100 representative commercial, industrial and agricultural sites. The purpose of the on-site visits was two-fold. First, we needed to verify that the measures were installed, that they were installed correctly, and that they were still functioning properly. Second, we needed to collect the data necessary to improve the accuracy of the energy savings estimated in the application.

The energy efficiency measures analyzed included reduce wattage and lighting controls, refrigeration efficiency improvements and motor replacement and controls, as well as some miscellaneous measures.

Research Approach

The research used an engineering approach to gather on-site data for 73 CIA Customized Rebate sites, to complete engineering calculations for the energy savings estimates of the energy efficiency measures, and to compare the on-site results to the estimated savings on the rebate applications. The Customized Rebate Program offers financial incentives to customers who undertake large or complex projects saving gas or electricity. The on-site results are essentially refined engineering estimates based on data gathered in site visits.

Sample Selection

The sampling frame for the on-site survey sample was constructed from the program application database that PG&E maintains for this program. Each applicant who received a rebate check in 1990 or 1991 was considered. Overall, there were a total of 2785 paid applications for the CIA customized rebate program.

The program application database was stratified according to: 1) measure end-use applied for (lighting, motors, and miscellaneous), 2) business type (commercial, industrial, and agricultural), and 3) geographical location. It was decided to use a sample of 100 applications in anticipation of completing at least 50 or as many as 100 on-site surveys. The 100 applications total were allocated to those measure/business types/location strata where energy savings estimates were of significant magnitude, but somewhat uncertain, usually due to generic or uncertain assumptions in the calculations.

The primary and back-up sites were randomly selected within each stratum. This ensured that a minimum number of on-site visits could be completed, given that some customers would not want to participate.

The survey sample is shown in Table 1.

On-Site Survey Procedures

The on-site surveys were completed for the sample listed during the months of January and February 1992. Each visit was scheduled by contacting the customer's facility representative listed on the rebate application, explaining the purpose of the on-site visit and arranging a convenient appointment for the data collection visit. The field staff conducting the on-site surveys were engineers experienced in performing surveys on a variety of commercial and industrial buildings. Training was conducted on the particular survey instrument for this project so that the information collected was consistent with the requirements of the study.

The on-site surveys consisted of a complete visual inspection of the number and type of installed equipment, interviews with facility staff on operation, and collection of energy-use data. The energy-use data included but were not limited to: billing data and measured current and/or voltage.

	Business Type					
	Agricultural		Commercial		Industrial	
End-Use	Applicants	Sample	Applicants	Sample	Applicants	Sample
Lighting	37	1	1322	28	150	7
Refrigeration	10	1	71	4	30	1
Miscellaneous	747	18	294	4	124	9

Table 1. Survey Sample

Total Applications = 2785
Total Surveyed Sites = 73

Installation of lighting measures was verified when engineers inspecting the number and installation of light bulbs, ballasts, reflectors and controls. Lighting measures were itemized for each sub-area of the facility, such as storage rooms as well as the main sales or work areas. Motor and refrigeration information was obtained from visual inspection of configurations and nameplate data. In addition, verification of variable speed drives was made through audio or visual observation of reduced speeds. Clamp-on voltage meters and amp meters were used to verify other assumptions.

Agricultural conservation measures were verified by visual inspection of site and installation, the check of nameplate data on pump motors, interviews with the pump operators, and review of pre- and post- pump data submitted with the rebate applications.

Results of Analysis

The energy savings estimates included in the PG&E customized rebate applications were obtained using a variety of methodologies. A wide range of assumptions was also found for the customized rebate applications. The review of calculation methodologies and the verification of assumptions was key to calculating the energy savings in this analysis.

The analysis identified the program savings for the sample at 110% of its reported kWh savings, 138% of its reported kW savings and 91% of its reported gas savings. These comparisons are shown in Figures 1, 2 and 3 by market segment and as a total.

The savings calculation methodologies on the applications vary widely in complexity, depending on the energy conservation measure. For example, lighting calculations were as simple as hours of operation times kilowatts saved, whereas refrigeration calculations involved assessment of pre- and post- compressor configurations, controls, pump sizes, efficiencies and hours of operation. The majority of the methods (96%) were considered valid methods and the calculations were corrected using an acceptable methodology.

On-Site Results

The results of the on-site surveys are summarized in this section. For each on-site survey, a survey report was completed including a brief description of the project, a summary of the savings estimates, and a description of the methodology used to verify the savings estimates. Additional documentation include a review of the calculation methodology and assumptions used by PG&E in the initial application and comments from the surveyors regarding site and equipment conditions.

Lighting

The energy savings calculated for all lighting measures in all business types based on the on-site surveys are shown in Table 2.

The most common lighting measures are replacement of incandescent lamps with compact fluorescents or HID lamps, delamping existing fixtures, and the installation of optical reflectors or occupancy sensors. The increase in
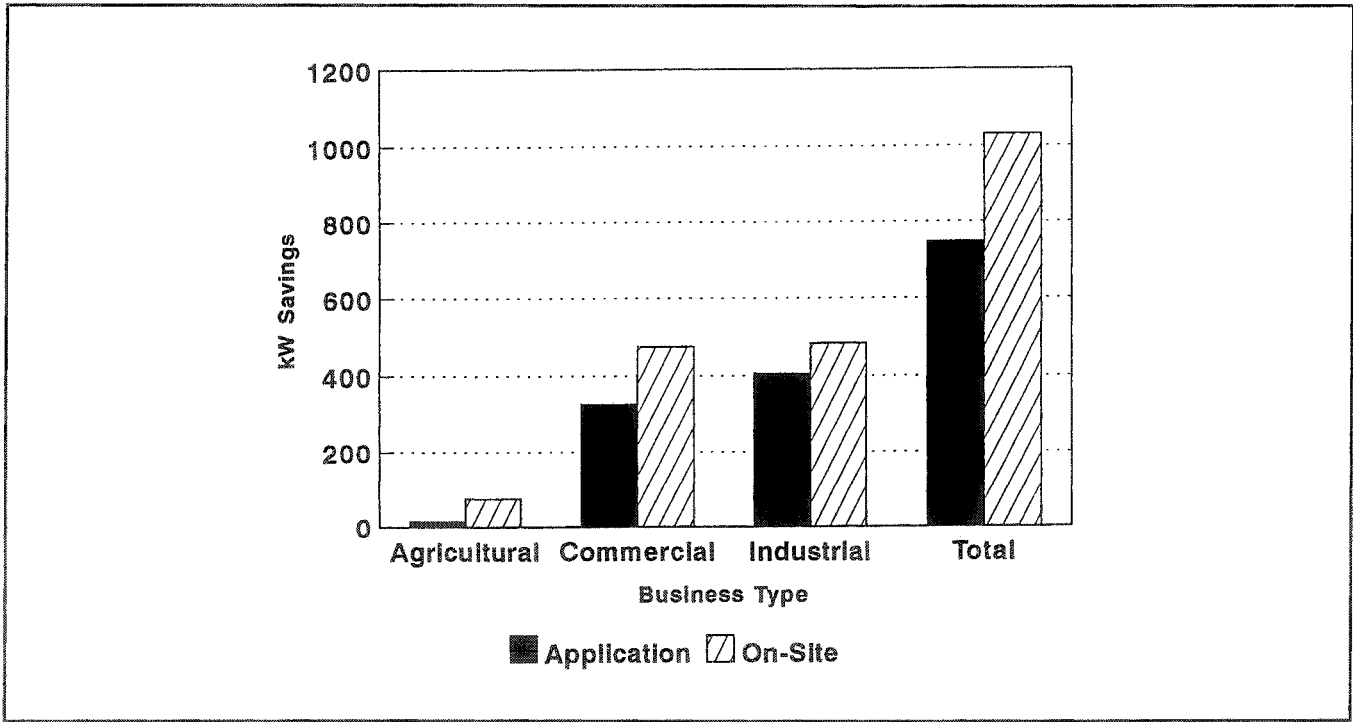
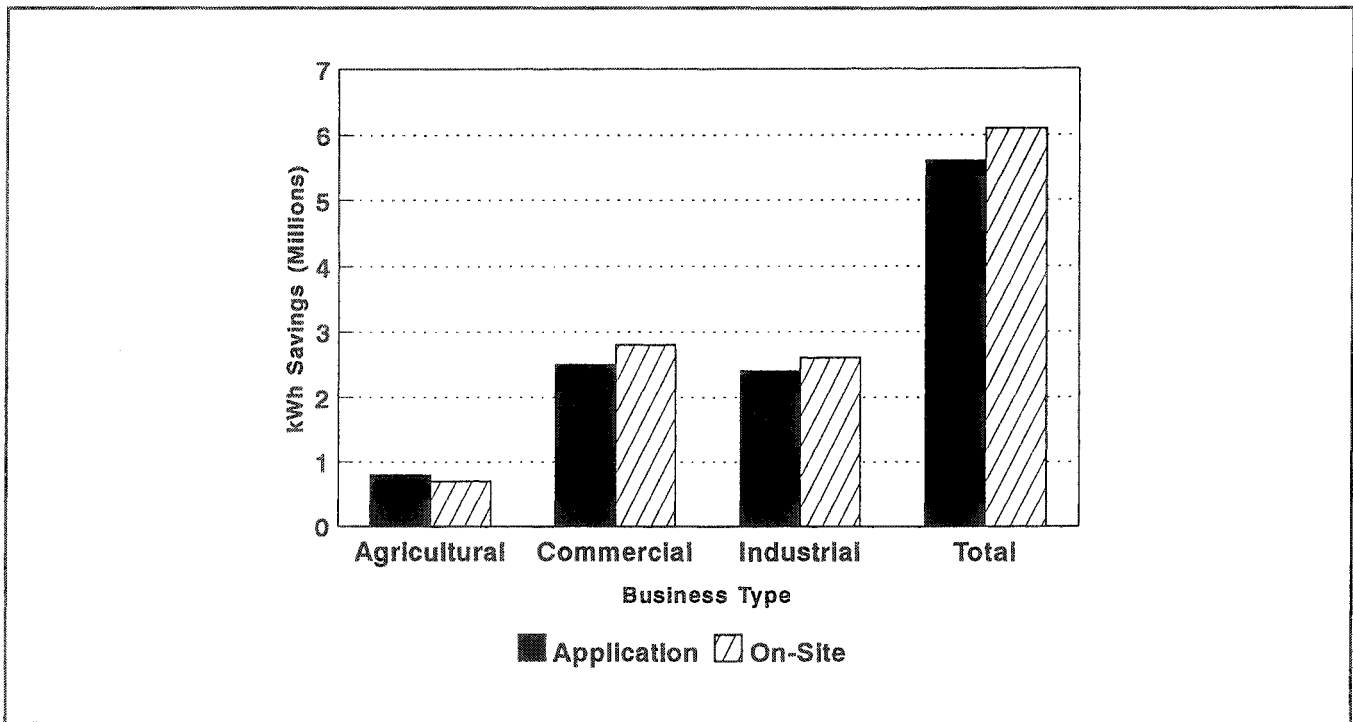*Figure 1. Demand Savings Comparison*
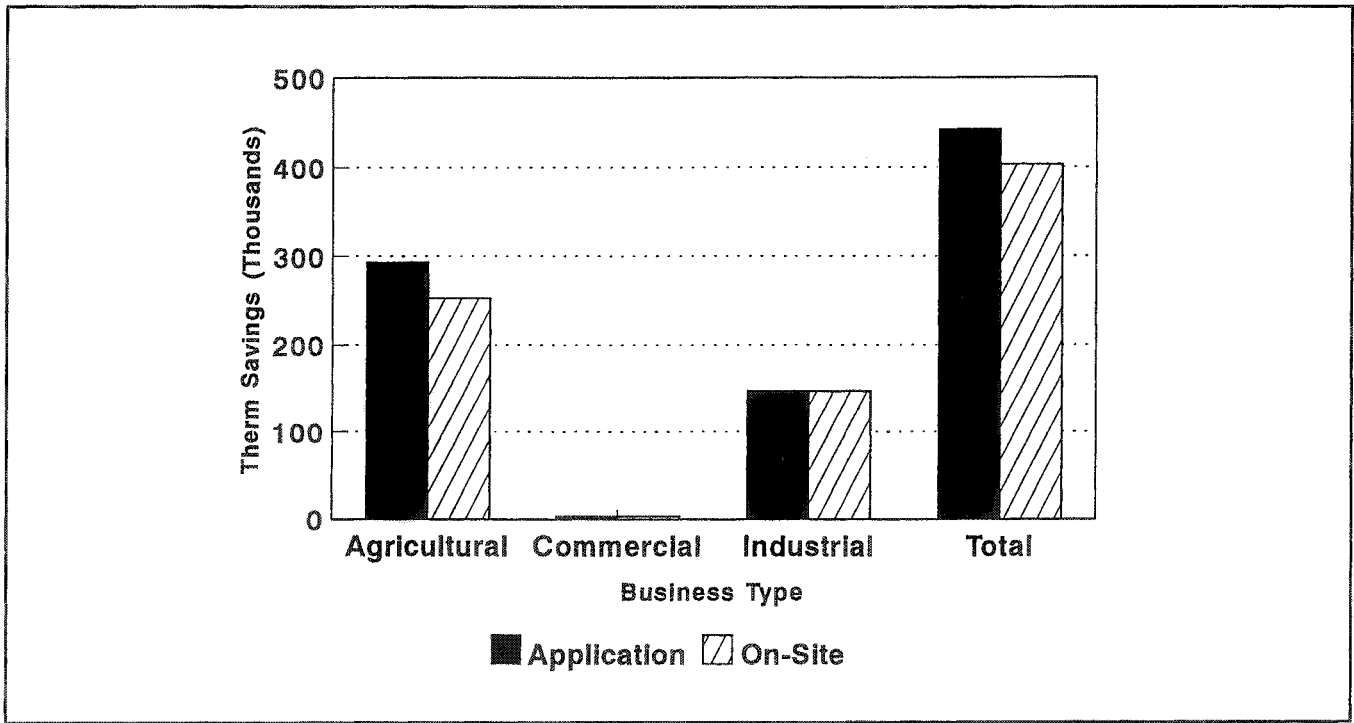

Figure 2. Energy Savings Comparison

Figure 3. Natural Gas Energy Savings Comparison

Table 2. Lighting Demand (kW) and Energy (kWh) Savings Summary

	Application	Survey	Difference	%Difference
Lighting kW	387	534	147	37.8 %
Lighting kWh	2,271,000	2,647,000	375,600	16.5%

energy savings compared to the on-site surveys was due to either the reduction of connected load or increased operating hours, both of which were field verified.

Refrigeration

The energy savings calculated for all refrigeration measures in all business types based on the on-site surveys are shown in Table 3.

Refrigeration measures included the installation of efficient refrigeration systems, automatic controls, insulated freezer cases and hot gas defrost systems. The differences in the savings calculations from application to on-site results were due primarily to the non-installation of measures and the over-estimation of operating hours. The large difference in kW savings is primarily attributable to refrigeration control systems actually installed although not claimed on the rebate application.

Miscellaneous

The energy savings calculated for all the remaining miscellaneous measures for all business types are shown in Table 4.

Considering that these are customized rebate applications, the miscellaneous measures contain a variety of different end use measures, with motor replacement being the most common measure.

Gas Savings

Natural gas savings were investigated and calculated for four sites: two agricultural customers, one commercial customer and one industrial customer. The reductions in savings were due to incorrect assumptions about greenhouse heating for the two agricultural customers.

Table 3. Refrigeration Demand (kW) and Energy (kWh) Savings Summary

	Application	Survey	Difference	%Difference
Refrigeration kW	52	141	89	171%
Refrigeration kWh	668,000	546,000	-122,000	-18.3%

Table 4. Miscellaneous Demand (kW) and Energy (kWh) Savings Summary

	Application	Survey	Difference	%Difference
Miscellaneous kW	308	357	49	16.0 %
Miscellaneous kWh	2,666,000	2,950,000	285,000	10.7%