

Don't Phone it in - On-Sites are Necessary: Self-Report versus On-site Data Collection

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ABSTRACT

Commercial baseline surveys are conducted to collect information on characteristics of customers and the types and efficiencies of equipment in their businesses. Baseline data are usually collected using either telephone surveys or on-site surveys. Telephone surveys are used to collect baseline data due to their reduced cost of data collection while on-site surveys are preferred for their accuracy. The analysis presented in this paper compares phone survey responses to questions pertaining to lighting technologies, cooling, distributed generation, televisions and site specific characteristics like square footage of premises with site verification findings. The phone survey gathered information regarding customer awareness, attitudes, site characteristics, types of equipment installed at the facilities and characteristics of the equipment. The data collected through the on-site surveys included data on the saturation and number of electric measures at the facility, information on the size and condition of the equipment, make and model numbers, and hours of operation for select measures. The findings described in this paper provide insight into the reliability of self-reported telephone survey information and whether the lack of accuracy in self-reported information revealed by onsite verifications is significant enough to warrant the added expense associated with on-site data collection.

Introduction

The California Public Utilities Commission (CPUC) funded the collection of commercial baseline and market share tracking data using a nested telephone and on-site survey design within the Commercial Saturation Survey (CSS) and Commercial Market Share Tracking (CMST) studies. The joint CSS/CMST telephone survey collected demographic information on California businesses, information on customer knowledge of utility programs and their environmental concerns, data on recent purchases of high priority measures by businesses, and data on the current saturation of electric equipment in commercial buildings from approximately 8,000 businesses in California. The telephone survey also enabled the recruitment of businesses for on-site visits. The combined CSS/CMST on-site surveys collected on-site data at 1,500 commercial businesses.

The extensive nature of the CSS/CMST telephone survey and the CSS on-site data collection effort enabled a detailed verification of telephone survey responses across an extensive range of measures and end-uses. The on-site survey participants were nested within the sites that participated in the telephone survey. The nested nature of the on-site survey participants within the telephone survey participants facilitates comparison between the self-reported phone data and verified on-site data for the same business. This paper reports on the findings of these two analyses

to illustrate the nature and extent of inaccuracies in self-report data collected by telephone surveys in support of commercial baseline studies.

Methodology

Data from the CSS/CMST onsite surveys and the self-reported telephone survey were analyzed and a comparison was undertaken using two approaches. This analysis focuses on the measures which were chosen as high priority for the CSS/CMST study, i.e., linear fluorescent lighting, split and packaged cooling, and televisions. First, the study compared the overall weighted incidence rate of measures and end uses from the phone survey to the incidence rate derived from the on-site survey. This comparison uses all of the responses from the telephone and the on-site data collection effort to compare the incidence of end uses and measures within these two surveys. The Aggregate Incidence Analysis does not directly analyze the accuracy of any given site's response, but looks at the ability of all businesses who participated in both the phone, and the onsite surveys, to correctly respond on average. Given that many baseline analyses are interested in the incidence of end uses and measures, this comparison will shed light on the ability of telephone survey respondents to correctly report the incidence of measures. The goal of this analysis is to determine whether the average incidence of measures, after taking into account false positives and false negatives, across the telephone and on-site surveys is similar.

The second comparison looks specifically at the ability of businesses to correctly self-report the types of equipment at their facility. This comparison is restricted to those sites that participated in both the telephone and on-site surveys. The analysis compares the number of sites that stated that they have the equipment with the number of businesses that were found to have the equipment during the on-site survey. The analysis will also compare the number of sites that stated that they did not have the equipment, yet the equipment was observed in the facility during the on-site verification. The results from this analysis will provide information on the accuracy of matched telephone and on-site information.

Using the combined findings of these two analyses, this paper describes if phone survey respondents were able to accurately report equipment installed at their business, the magnitude of the differences between self-report data and on-site survey findings, and if the phone survey data provides an accurate account across all respondents, of the equipment installed by businesses in California.

Findings

The Aggregate Incidence Analysis

The Aggregate Incidence Analysis compares the share of sites that have a lighting, cooling, televisions and onsite generation measures installed at their site of business as self-reported by phone survey respondents with the share of sites with the same measure or enduse that are verified by onsite visits. Data for the incidence analysis are weighted to reflect the population of California IOU electric commercial customers. If the incidence or share of sites adopting a specific measure is one of the purposes for a baseline study, then this comparison provides information on the aggregate accuracy of the telephone survey information.

Table 1 presents the incidence for select measures where information was collected during the CSS telephone and on-site survey. The table reports the population weighted percentage of telephone and onsite surveys reporting the presence of lighting, cooling and other technologies.

Table 1. Technology Incidence for Telephone and On-Site Survey Participants (Percent of Businesses)

Technology	Telephone Survey (n = 7,890)	On-site Survey (n = 1,439)	Telephone Incidence Relative to On-site
Linear Fluorescents	79%	94%	- 15%
T12/ Fat tubes	19%	42%	- 23%
T8/ Second Generation T8/ Skinny Tubes	43%	71%	- 28%
T5	5%	6%	-1%
CFLs	47%	62%	- 15%
LEDs	19%	4%	15%
Occupancy Sensors	21%	17%	4%
No Cooling	25%	23%	2%
Split System – Cooling	9%	12%	- 3%
Packaged System – Cooling	37%	52%	- 15%
TV	38%	47%	- 9%
Solar PV	3%	2%	1%

As seen, the aggregate incidence of measures in the telephone survey are generally under-reported relative to what is found during the on-sites survey. During the telephone survey, customers were asked if they had linear fluorescents installed at their facility. Seventy nine percent of telephone survey respondents reported that their facility’s lighting included linear fluorescents while 94% of businesses participating in the baseline on-site data collection were found to have linear fluorescents. The incidence of CFLs, TVs, and split and packaged HVAC systems are also under-reported.

When phone survey respondents were asked to describe the types of linear technologies installed at their facility, 19% of sites indicated that have T12s (T12s or fat tubes) while 42% of businesses in the on-site survey were found to have T12 lighting. The substantial under-reporting of the presence of linear fluorescents contributes to the under-reporting of T12 technology. T8 technology is also under-reported in the telephone survey at 43%, relative to the 71% incidence of T8s found during the on-site survey. Telephone survey respondents were substantially less likely to report the presence of linear technologies and substantially less likely to indicate that their facility had multiple types of technology than was observed on-site.

Measures where the telephone survey incidence and the on-site incidence are similar include solar PV, T5, and the lack of a cooling system. The incidence of LEDs was over-reported during the telephone survey. It is possible that telephone survey respondents are confused by CFL and LED technologies, leading to an under-reporting of CFLs and an over-reporting of LEDs.

The Site Level Comparison Analysis

The site level comparison analysis is a site specific analysis. It is not weighted up to the population of sites in the analysis, it compares the site level telephone responses with the on-site observations, including only those sites that participated in both the telephone and on-site studies, and looks at under-reporting and over-reporting, false positives and false negatives. No single site can influence the overall outcome of the analysis more significantly than any other. The comparison analysis also analyzes the data by customer size to determine if large or smaller sites more frequently over or understate the presence of equipment.

Comparison of Phone and On-site Survey Findings for Business Square Footage

The analysis found that when business square footage information is collected, large sites are less likely than very small sites to self-report within ten percent of verified square footage.

Figure 1 Business Square Footage: Difference between Phone and On-site Data Findings (Percent of Businesses)

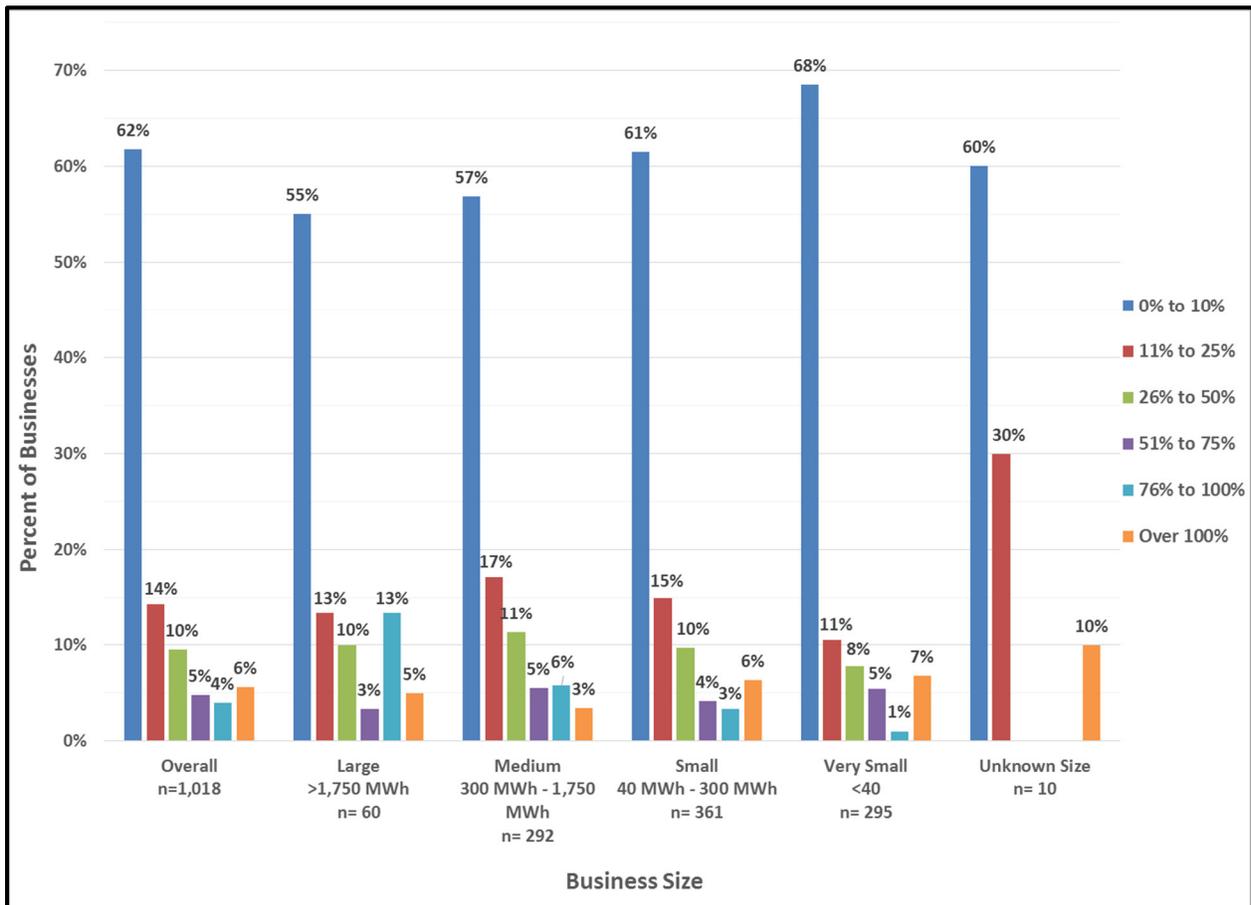


Figure 1 presents the comparison of the phone and on-site business square footage for the 64% of telephone survey sites that provided an estimate of square footage during the telephone survey. The on-site data collection effort found that 62% of the sites that provided an estimate of

square footage were within ten percent of the square footage verified during the onsite survey.

Comparison of Phone and On-site Survey Findings for Linear Fluorescents

A high share of sites were found to incorrectly state that they do not have linear fluorescents, which is consistent with the finding that the aggregate incidence of linear technologies from the on-site survey is substantially higher than the incidence from the telephone survey data. The data in Table 2 indicates that nearly 100% of the sites that reported that they have linear fluorescent lamps during the phone survey were found to have linear fluorescents on-site. However, of the 144 telephone/on-site survey businesses that self-reported that they did not have linear technologies during the telephone survey, 83% were found have linear fluorescents during the on-site survey.

Table 2. On-site Verification of Self-Reports of Linear Fluorescents (Percent of Businesses)

Linear Fluorescent Lighting Present?	Verified On Site	Not Verified On Site		n
		False Negative	False Positive	
Telephone – Yes	99%		<1%	1,269
Telephone – No	17%	83%		144
Overall	91%	8%	< 1%	1,413

T12 Linear Technologies. The on-site data collection effort found that 41% (583 of the total of 1,439 on-sites) of the sites continue to have older linear fluorescent technologies like T12s. The under-reporting of T12s is consistent with the finding that the aggregate incidence of T12s is substantially higher in the on-site data than in the telephone survey. The data in Table 3 indicates that 63% of the businesses that reported that they have T12 linear fluorescents during the phone survey were found to have T12 linear fluorescent lamps on-site. In addition, for 65% of the businesses that stated during the phone survey that they did not have T12 linear fluorescents, none were found on-site.

Table 3. On-site Verification of Self-Reports of Linear Fluorescent T12s (Percent of Businesses)

T12s Present?	Verified On Site	Not Verified On Site		n
		False Negative	False Positive	
Telephone – Yes	63%		37%	265
Telephone – No	65%	35%		1,174
Overall	64%	29%	7%	1,439

T8 Linear Technologies. During the on-site survey, more businesses were found to have T8 linear technologies than self-report these technologies during the telephone survey. This finding is similar to the findings for T12s, where more businesses were found to have T12s than self-report during the phone survey. The on-site findings supporting a higher share of businesses having T8s and T12s than is self-reported during the telephone survey is in part due to a high incidence of businesses having both T12 and T8 technologies. During the phone survey only 8% of businesses that later participated in the on-site survey, self-reported that their facility had both

T12s and T8s. During the on-site survey, however, over 30% of businesses were found to have both T12s and T8s. Future telephone survey efforts could potentially word questions to describe technologies to customers if they have multiple types of linear lamps, for instance, those that are fatter (T12), those that are thin (T8) and those that are skinny (T5).

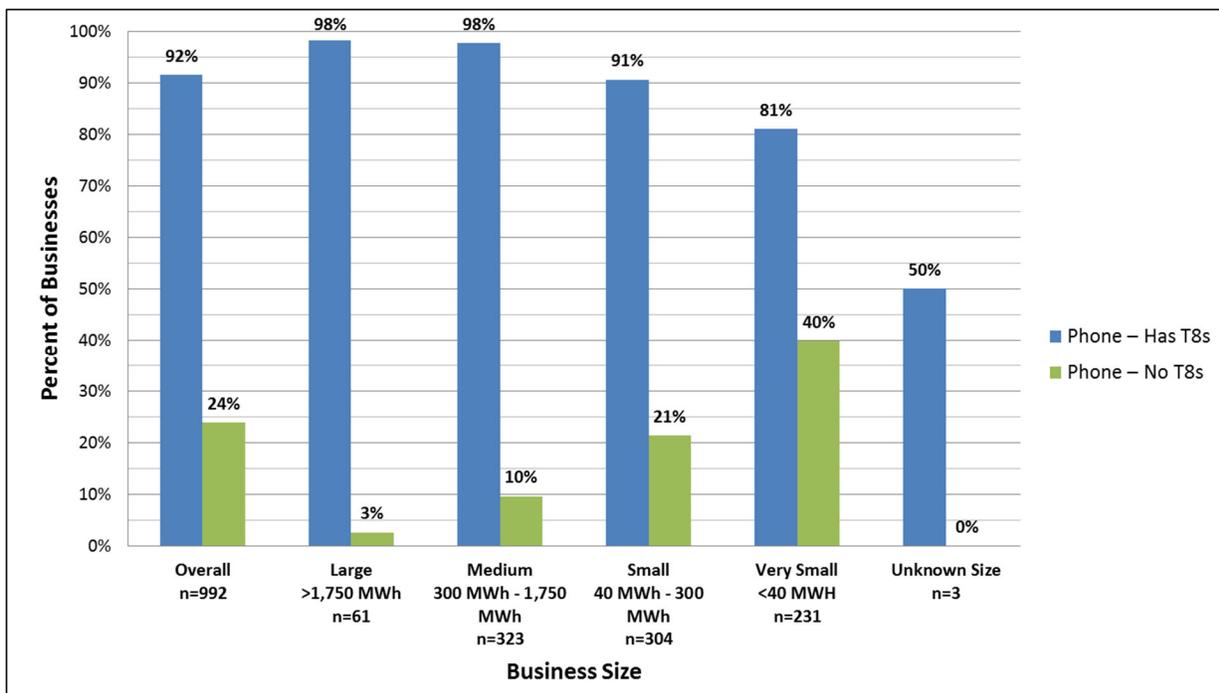
As seen in Table 4, 854 of the 1,439 on-site survey businesses or 59% of sites self-reported the presence of T8 technologies. The on-site data indicate that 92% of the businesses that self-reported that they have T8 linear fluorescents during the phone survey were found to have T8 linear fluorescents on-site. For sites self-reporting that they do not have T8 technologies (585 of 1,439 on-site survey businesses), 76% of the respondents were found to be incorrect during the on-site survey.

Table 4. On-site Verification of Self-Reports of Linear Fluorescent T8 Technology Present in the Facility (Percent of Businesses)

T8s Present?	Verified On Site	Not Verified On Site		n
		False Negative	False Positive	
Telephone – Yes	92%		8%	854
Telephone – No	24%	76%		585
Overall	64%	31%	5%	1,439

Figure 2 illustrates the share of businesses that correctly answered the telephone survey question concerning the presence of T8 linear fluorescents in their facility.

Figure 2. On-site Verification of Self-Reports of T8 Linear Fluorescent Lighting by Business Size (Percent of Businesses)



These data show that larger businesses are more likely correctly report that they have T8s (60 of 61 sites responding that they had T8s over phone were verified as having T8s) and more likely to incorrectly state that they do not have T8s than smaller sized sites.

T5 Linear Technologies. In the telephone survey, 160 of the sites that participated in the on-site survey reported having T5 technology while the on-site survey found that 188 sites had T5 technology in their facility. The relative similarity of these numbers explains the relative similarity of the incidence of T5s within the telephone and on-site data (5% and 6% respectively), while the comparison data indicates that much of the telephone survey data represents a false positive. These data support the conclusion that while the aggregate incidence analysis found that the telephone and on-site incidence of T5s was similar, the comparison analysis finds that individuals sites that state that they have T5s are more likely to be incorrect than correct. The data in Table 5 indicates that 38% of the businesses that self-reported that they have T5 linear fluorescents during the phone survey and 90% of businesses self-reporting that they do not have T5 technologies are found to be correct during the on-site survey.

Table 5. On-site Verification of Self-Reports of Linear Fluorescent T5 Technology Present in the Facility (Percent of Businesses)

T5s Present?	Verified On Site	Not Verified On Site		n
		False Negative	False Positive	
Telephone – Yes	38%		62%	160
Telephone – No	90%	10%		1,279
Overall	84%	9%	7%	1,439

Comparison of Phone and On-site Survey Findings for Compact Fluorescents

The site level comparison analysis found that more businesses have CFLs than those who self-report during the telephone survey. Table 6 presents the comparison of the phone and on-site findings for the presence of compact fluorescents in the facility.

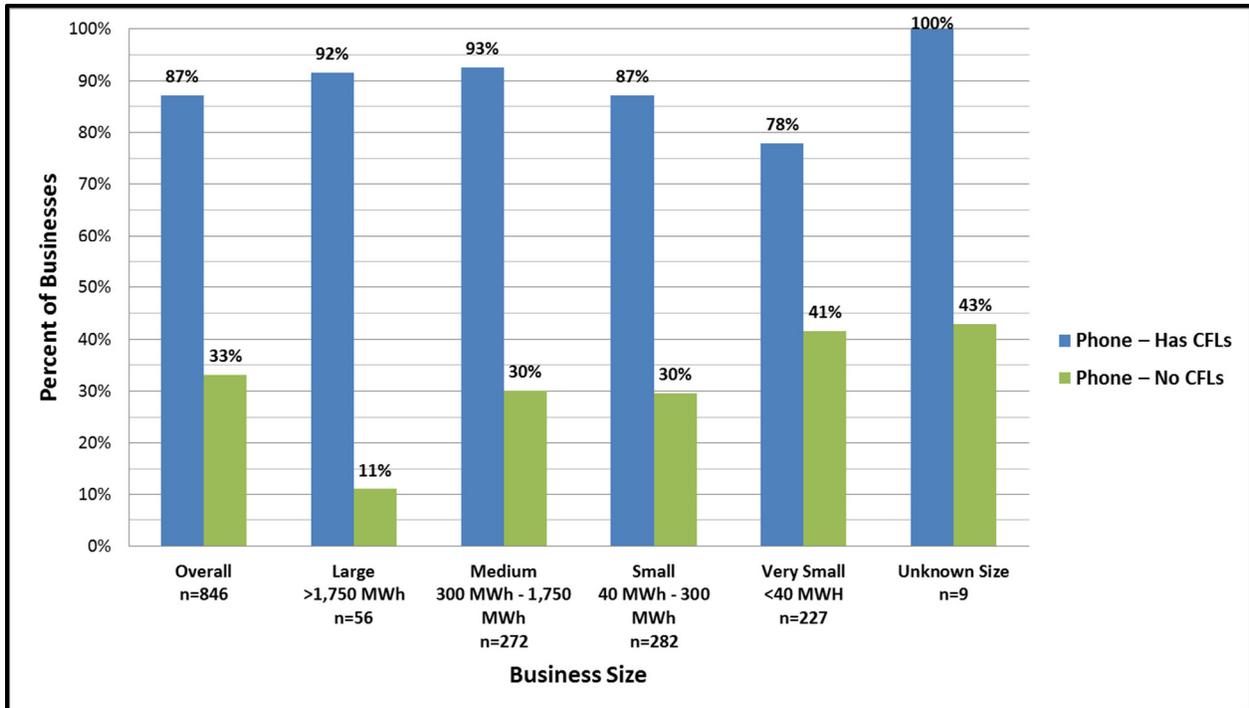
Table 6. On-site Verification of Self-Reports of Compact Fluorescents Present in the Facility (Percent of Businesses)

CFLs Present?	Verified On Site	Not Verified On Site		n
		False Negative	False Positive	
Telephone – Yes	87%		13%	713
Telephone – No	33%	67%		
Overall	61%	33%	7%	1,391

These data indicate that 87% of the businesses that reported that they have compact fluorescents during the phone survey were found to have compact fluorescents on-site. Of the 1,453 sites that participated in both the telephone survey and the collection of CFL data on-site, 713 sites in the

phone survey responded that they had CFLs while 1,136 sites were found to have CFLs during the on-site survey. The dramatic increase in the number of sites verified to have CFLs during the on-site is consistent with the findings from the incidence analysis. Of the 62 phone survey respondents said they did not know if they had CFLs at their businesses, 52 had CFLs. Figure 3 illustrates the share of sites that correctly answered the telephone survey question concerning the presence of compact fluorescents in their facility.

Figure 3. On-site Verification of Self-Reports of Compact Fluorescents by Business Size (Percent of Businesses)



These data indicate that when businesses self-reported that they did not have compact fluorescents, they tended to be incorrect most of the time, and larger sites are more likely to make a mistake than smaller sites. When very small businesses self-report that they do not have CFLs they are correct 41% of the time but large businesses are only correct 11% of the time when they state that they do not have CFLs. These findings support the need for on-site surveys when collecting data on rapidly changing technologies that individuals may not fully understand.

Comparison of Phone and On-site Survey Findings for LEDs

Approximately 79% of the phone survey respondents who also participated in the on-site survey correctly knew if they did or did not have LEDs. These findings indicate that with this relatively new technology, respondents were far more likely to be correct when they believed that they did not have the technology than when they self-reported that they had the technology. The relative novelty of the technology, combined with the many different types of lighting technology,

may have led to some confusion for businesses that reported that they had installed LEDs.¹ The data in Table 7 indicates that only 34% of the sites that self-reported on the phone survey that they had installed LED were found to have LEDs. In contrast, 88% of the sites that stated during the phone survey that they did not have LEDs were found during the on-site collection to not have LEDs.

Table 7. On-site Verification of Self-Reports of LEDs Installed (Percent of Businesses)

LEDs Present?	Verified On Site	Not Verified On Site		n
		False Negative	False Positive	
Telephone – Yes	34%		66%	158
Telephone – No	88%	12%		767
Overall	79%	10%	11%	925

Comparison of Phone and On-site Survey Findings for Cooling Present

Only 40% of the businesses that stated during the phone survey that they did not have cooling were found to actually have no equipment during the on-site. In total, approximately 83% of the phone survey respondents who also participated in the on-site survey correctly knew if they did or did not have cooling equipment. The data in Table 8 indicate that 91% of the businesses that reported that they had cooling equipment during the phone survey were found to have cooling on-site. Customers were less likely to be correct if they stated that they used no equipment to cool their facility.

Table 8. On-site Verification of Self-Reports of Cooling Present in the Facility (Percent of Businesses)

Cooling Present?	Verified On Site	Not Verified On Site		n
		False Negative	False Positive	
Telephone – Yes	91%		9%	1,082
Telephone – No	40%	60%		188
Overall	83%	9%	8%	1,270

The errors for customers that stated that they did not have cooling equipment and then were found to have equipment on-site may be explained, in part, by new purchases between the time of the phone survey and the on-site survey. Another potential source of disparity is the wording of the phone survey question, which directly asks what kind of equipment is *used to cool the facility*, rather than simply asking if cooling equipment is present. If a site has cooling equipment, but does not use the equipment to cool their facility, they may have replied no equipment was present to cool the facility. The phone survey analysis interprets this information as the absence of cooling equipment at the facility. In a temperate climate like some areas of California, where cooling may

¹ Note, the LED questions were added to the telephone survey after it was initially launched and were not asked of all telephone survey participants.

not be crucial, it is very important to carefully word questions concerning the presence of cooling equipment.

Comparison of Phone and On-site Survey Findings for Televisions

Close to 80% of the phone survey respondents who also participated in the on-site survey correctly knew if they did or did not have a TV and sites were slightly more likely to know if they had a TV than if they did not have a TV. The higher share of error for sites that stated that they did not have a TV may in part be explained by TV purchases between the time of the phone survey and the on-site survey. The data in Table 9 indicates that 84% of the businesses that reported that they had a TV during the phone survey were found to have a TV on-site. In addition, for 73% of the businesses that stated during the phone survey that they did not have a TV, no TV was found on-site.

Table 9. On-site Verification of Self-Reports of Televisions Present in the Facility (Percent of Businesses)

TVs Present?	Verified On Site	Not Verified On Site		n
		False Negative	False Positive	
Telephone – Yes	84%		16%	831
Telephone – No	73%	27%		547
Overall	79%	11%	10%	1,378

Comparison of Phone and On-site Survey Findings for On-site Distributed Generation Technology

Table 10 presents the comparison of the phone and on-site findings for the presence of solar panels on the facility. These data indicate that 81% of the sites that reported having solar panels during the phone survey were found to have solar panels on-site.

Table 10. On-site Verification of Self-Reports of Solar Panels Present in the Facility (Percent of Businesses)

Solar Panels Present?	Verified On Site	Not Verified On Site		n
		False Negative	False Positive	
Telephone – Yes	81%		19%	84
Telephone – No	99%	1%		1,336
Overall	98%	< 1%	1%	1,420

In addition, for 99% of the sites that stated during the phone survey that they did not have solar panels, no solar panels were found on-site. In total, approximately 98% of the phone survey

respondents who also participated in the on-site survey correctly knew if they did or did not have solar panels (68 of the 84 sites who said they did and 1,327 of the 1,336 who said over phone that they didn't have solar panels), and sites were more likely to know if they did not have solar panels than if they did have solar panels.

The discrepancies in the phone and onsite survey findings regarding the presence of solar generation is relatively low. Sites incorrectly stating that they have solar panels when none is found on-site, however, are still unexpected. Looking carefully at these sites, it was found that some of the sites have solar thermal, which is recorded on the on-site survey form, but is not recorded as solar or photo voltaic. Some of the sites are schools or individual businesses from a chain of businesses. For schools and chain businesses the phone survey often spoke with an individual from the central office. It is likely that incorrect responses to the presence of solar may indicate that the respondent was confused about the exact site being discussed. The site contact was possibly correct about a different address within the school district or business chain. Other instances of error for this question remain unexplained.

The telephone survey respondents also replied with energy generation equipment other than solar installed in their facility. Table 11 presents the comparison of the phone and on-site findings for the presence of other energy generation equipment in the facility. In total, approximately 89% (10 of the 24 sites who said they did and 1,250 of the 1,396 who said over phone that they didn't have non-solar energy generation equipment), of the phone survey respondents who also participated in the on-site survey correctly knew if they did or did not have energy generation equipment.²

Table 11. On-site Verification of Self-Reports of Other Types of Distributed Generation in the Facility (Percent of Businesses)

Other DG Present?	Verified On Site	Not Verified On Site		n
		False Negative	False Positive	
Telephone – Yes	42%		58%	24
Telephone – No	90%	10%		1,396
Overall	89%	10%	<1%	1,420

Conclusions

The results of the incidence analysis found that the incidence of measures and end uses in the telephone survey were generally under-reported relative to what was found during the on-sites. Respondents typically under-reported the incidence of multiple types of technologies in their business. The site specific comparison analysis provided information on the accuracy of matched telephone and on-site data. Large businesses were found to have greater discrepancies in phone

² The “Other” types of energy generation equipment found during the onsite survey included internal combustion engines, gas turbines, micro turbines, solar thermal, and fuel cells.

and on-site survey findings regarding the square footage of their premises than small businesses. Large businesses also incorrectly report not having CFLs, Linear technologies and Televisions more than Small businesses. Customers were found to have substantial difficulty self-reporting on the measures and end uses present at their facilities. Results indicate that telephone survey respondents misrepresent their Lighting and HVAC systems. The analysis indicates that telephone survey respondents often know if they have a general class of technologies (linear technologies and TVs) but have less understanding of the specifics of the technologies (T12s, T8s, T5, CFLs, or LEDs). With the possible exception of LEDs, there is very little evidence that the accuracy of responses was dependent on the end use or the novelty of the technology. These results do suggest the need for onsite surveys especially where new or rapidly changing technologies are being analyzed. The magnitude of discrepancy for the existence of distributed generation equipment while low, still exists.

The findings from the incidence and comparison analyses suggest that using telephone surveys as the primary form of data collection for commercial equipment baseline studies may not lead to entirely reliable results and highlight the importance of using on-site surveys to collect information on the saturation of end uses and measures in commercial facilities. It is generally acknowledged that onsite surveys provide reliable information regarding measures installed at a facility, they are expensive and time consuming, which limits the frequency with which they can be implemented. Onsite surveys allow for extensive collection of data, by means of visual verification of installations, collection of photographs and nameplate information, in addition to interviews with on-site personnel, and additionally allow for the collection of inputs for a more detailed secondary analysis of the efficiency of the equipment found onsite. Telephone survey data represent the site contact's best understanding of measures installed at their business, and can be hampered by the purchaser's understanding and ability to remember the technologies installed at their business. However, telephone surveys are not intrusive and enable a low cost option for collection of data from a large sample of the population. They also play an important role in the development of a better understanding of the distribution of business types, the collection of self-reported information on business knowledge, awareness, and preferences, and to recruit for on-site surveys. When attempting to balance competing demands for budgets, future researchers will need to determine the optimal mix of on-site and telephone survey data to help answer their research questions, but findings outlined in this paper support the need to continue with on-site surveys for baseline and impact studies.

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