



**EVALUATION, VERIFICATION, AND
MEASUREMENT STUDY
FY 2007/2008 Program
For the Port of Oakland**

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Submitted to: Port of Oakland

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1 INTRODUCTION

The Port of Oakland is part of the City of Oakland and occupies 19 miles of waterfront on the eastern shore of San Francisco Bay, with about 900 acres devoted to maritime activities and another 2,600 acres devoted to aviation activities. The Port of Oakland (the Port) also owns and manages more than 900 acres of developable land, including Jack London Square, Embarcadero Cove and the Oakland Airport Business Park. It has about 200 electric utility customers, all of whom are commercial. For these customers, the Port offers energy audits, equipment rebates, and lighting retrofit rebates.

1.1 Background

Two legislative bills (SB1037 and AB2021) were signed into law a year apart. SB1037 requires that the Publicly Owned Utilities (POUs), similar to the Investor Owned Utilities (IOUs), place cost effective, reliable, and feasible energy efficiency and demand reduction resources at the top of the loading order. They must now procure 'negawatts' first. Additionally, SB1037 (signed September 29, 2005) requires an annual report that describes the programs, expenditures, expected energy savings, and actual energy savings.

Assembly Bill 2021, signed by the Governor a year later (September 29, 2006), reiterated the loading order and annual report stated in SB1037 as well as expanding on the annual report requirements. The expanded report must include investment funding, cost-effectiveness methodologies, and an independent evaluation that measures and verifies the energy efficiency savings and reductions in energy demand achieved by the energy efficiency and demand reduction programs. AB2021 additionally requires a report every three years that highlights cost-effective electrical and natural gas potential savings from energy efficiency and established annual targets for energy efficiency and demand reduction over 10 years.

1.2 Objectives

The primary objective of this EM&V effort at the Port is to verify the estimates of energy impacts from energy conservation activities during FY 2007/2008 and adjust the savings estimates if necessary.

2 IMPACT EVALUATION OF THE NON-RESIDENTIAL CUSTOM PROGRAM - LIGHTING

The primary objectives of an impact analysis are to assess gross and net demand and energy savings and the cost-effectiveness of the installed systems. An impact evaluation verifies measure installations, identifies key energy assumptions, and provides the research necessary to calculate defensible and accurate savings attributable to the program. The methodology and activities used in the impact evaluation are discussed below.

The only customer to participate in the FY 2007/2008 Non-Residential Custom Program for the Port of Oakland performed a lighting retrofit and submitted five separate incentive applications for different portions of it. This accounted for 100% of program savings and was therefore verified with a site visit and a review of documentation.

2.1 Impact Evaluation Methodology Overview

The methodologies employed to measure and verify energy savings attributed to the Non-Residential Custom Program included the following activities:

1. Verify measure installation.
 - a. Developed a sample for field verification activities, which consisted of the only site to receive an incentive under the program.
 - b. Conducted field verification activities and observations.
2. Reviewed applications and supporting documentation provided to the Port of Oakland.
3. Developed adjusted measure savings values based on field activities and data reviews.
4. Provided conclusions and recommendations for the Port of Oakland Non-Residential Custom Program.

These activities are discussed in detail in the following sections. Additional detailed information may be found in the appendices.

2.2 Measure Installation Verification

The objectives of the verification activities were to complete site visits and collect key energy program performance metrics including:

1. Establishing the presence of energy efficient measures by comparing the number of installations observed with the number of installations recorded in the rebate application.
2. Providing input on the quality of installations observed – including whether or not they were operating correctly.
3. Where observed equipment did not match program reported installations, determine if retrofits/installations were ever present, and/or the reason that the installation plan changed.
4. Recording key facility performance data, such as daily schedules, seasonal variations in schedules, and control strategies.

2.2.1 Installation Verification

The Port of Oakland had only one rebate issued in FY 2008. This was for a lighting retrofit at an industrial facility. The evaluation focused on the single lighting retrofit, which replaced 400 watt metal halide fixtures with a combination of four and six lamp high output T5 fixtures. The application included floor plans showing the fixture locations and intended retrofits.

2.2.2 Site Verification Activities

Field activities involved two components:

1. Evaluators coordinated with the implementation contractor and primary customer contacts to establish field activity dates and identify site level contacts.
2. While on-site, the evaluation team conducted an area-by-area, measure-by-measure audit, noting retrofit count, type, and operating conditions. Interviews were also conducted at the site representative's convenience.

Field evaluation activities were conducted on October 20, 2008. At the time, it was anticipated and verified that all expected installations were completed and finalized.

2.2.3 Installation Verification Results

Verification work, discussions with participants subsequent to field verification activities, and an analysis of the verified installations indicated that the installations attributed to the Non-Residential Custom Program were installed, but the savings were not necessarily accurately calculated.

Site 1

The site consisted of a combination of four and six lamp high output T5 fixtures replacing 400 watt metal halide units. No occupancy sensors were installed. The itemized invoices listed a total of 289 four lamp and 32 six lamp T5 fixtures. However, hand written notes on the invoices in some cases showed adjusted numbers so it is unclear if all of these were installed or if more might have been ordered at another time. A manual count of the fixtures resulted in 291 four lamp and 23 six lamp T5 fixtures, so this number has been used to calculate savings.

The application indicated 4,576 hours of operation in most areas, corresponding to 88 hours per week. The area that included one of the walkways listed 4,784 hours per year or 92 hours per week. Since this was a relatively heavy traffic area, the increased hours were considered reasonable. Facility personnel indicated that these hours were correct.

The application listed 324 metal halide fixtures removed and replaced with 309 four lamp and 12 six lamp T5 high output fixtures. Although the removed fixtures corresponded to those shown on the plans, as stated previously, the count performed during the site visit located 291 four lamp and 23 six lamp T5 units. Since this is also much closer to the numbers provided in the invoices than the values listed on the application, it has been accepted as correct. There were several variations since the plans had been drawn up and these were noted during the site visit.

The wattages used in the application were not consistent. In most places 458 watts was listed for the metal halide fixtures being removed. However, on one section 400 watts was used instead. Since 458 watts is the accepted standard value for a 400 watt metal halide fixture this has been used in all calculations. A

four lamp high output T5 uses 234 watts and a six lamp unit uses 351 watts. However, the applications listed 246 watts for a four lamp T5 fixture and 320 watts for a six lamp fixture, so this resulted in adjusted savings relative to the applications. Since no deemed value is available for high bay retrofits from metal halide to T5 units, no deemed savings were compared to the calculated values. Table 1 summarizes both the claimed and adjusted energy savings for Site 1.

Table 1: Site 1 Installation and Savings

	kW Savings	Annual kWh Savings
Claimed Savings	66.8	307,223
Verified Calculated Savings	72.2	332,837

2.3 Analysis

2.3.1 Overall Site Observations

There were two consistent problems with the applications:

1. *Inconsistencies between the reported fixtures on the application and the actual installation.* The itemized invoices provided with the applications showed adjustments from the reported installation. However, some of these changes may have been made during the installation. It would be useful to verify the fixture counts after the installation has been performed.
2. *Incorrect reporting of fixture wattages.* The wattages for both the four and six lamp T5 high output fixtures and some of the 400 watt metal halide units were misreported. Standard wattages for these fixtures are available and could be provided to vendors to correct this problem.

2.3.2 Program Record Observations

The final program records submitted by the implementation contractor to the Port of Oakland were analyzed for accuracy and consistency, and to ensure that the underlying assumptions were reasonable.

The key documents analyzed included the following:

- The project applications provided to the program for each site
- The invoices provided to the utility

The primary observations from this review were that the scope of work had changed slightly from the application and that the wattages used for many of the fixtures were inconsistent or non-standard.

Based on the review of program documents and on-site verification activities, the following conclusions were made.

1. The adjusted final installation rate was determined to be 108%. This was due to adjustments in the number and wattages of fixtures.
2. Since this was the only location that received incentives during the program year, the measure savings assumptions were calculated to be representative of the Program installations.
3. It would be advisable to explicitly request operating hours as part of the application rather than simply listing hours per year as a way to verify calculations. This would help clarify the four hour per week variance in one area of the facility.
4. Itemized purchase orders were provided with the application, but a verification of the final retrofit plans would also be useful.

2.4 Impact Evaluation Results

Table 2 provides the savings reported in the final installation review documents submitted for the Program and the verified gross savings. The recommended adjustments are attributable to revised savings estimates for a combination of fixture wattages and number of units installed. The overall realization rate is 108% of reported program savings.

Table 2: Claimed Savings and Verified Gross Savings

Project	Claimed		Verified	
	kW Savings	Annual kWh Savings	kW Savings	Annual kWh Savings
Site 1	66.8	307,223	72.2	332,837