

San Francisco small business lighting retrofit: Case Study

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SUMMARY

The paper reports on the results of a small business assistance program administered by the City of San Francisco with the goal of upgrading lighting in 40 small businesses. The Program provided incentives to businesses as a means of overcoming market barriers. The Program was a pilot for a larger program targeting about 4,000 facilities, currently underway.

Through April 1, 2002, the pilot program paid an average of \$682 US per kW reduced (783 EURO/kW) of incentives to Contractors on behalf of (13) end use customers, totaling 36% of the construction cost. The pilot program incurred additional costs of approximately \$200,000 US for administration (about 230,000 EURO). The proposed incentive strategy for the Full Program is to pay \$290 US (333 EURO) per site and \$195 US (224 EURO) per kW removed. The program will need to optimize the effect of marketing, auditing, sales, and construction activities to motivate businesses to participate.

The following sections outline the organizational structure of the Pilot Program, and detail the approach, results, and recommendations for future Marketing, Auditing, Sales, and Construction activities. Specific project examples are presented in a final "Case Studies" section, with the data collection form attached as Appendix A.

PURPOSE

Small business owners face market barriers to making capital improvements in facilities, particularly when they lease the property they occupy. Preliminary informal field surveys conducted by Program officials have indicated that the majority of small businesses in San Francisco, CA USA have not upgraded lighting systems to current standards.

The purpose of the paper is to report on the results of a small business assistance program that the City of San Francisco is currently administering with the goal of upgrading lighting systems in 40 small businesses. The Program sought to provide incentives to San Francisco small businesses as a means of overcoming existing market barriers.

The challenge of implementing lighting retrofits for leased property is widespread. Small business owners face an additional burden of scale when considering implementation of lighting upgrades, as small projects tend to cost more than large projects do on a unit price basis. Among businesses, small business owners face larger day to day financial risks than larger businesses do, making investment decisions that much more critical.

The Program was a pilot for a larger program (the Full Program) targeting approximately 4,000 facilities, which is currently underway. Newcomb Anderson Associates (NAA) provided the Program support to the City of San Francisco (the City) for the Pilot project, and is currently providing support for the Full Program. The Full program goals are 6,360 audits, 3,960 sites installed, and 5,940 kW installed. The Program Incentive strategy for the Full Program is to pay \$290 US (333 EURO) per site and \$195 US (224 EURO) per kW removed. The lessons learned from

this Pilot Program effort will be instrumental in helping to meet the goals of the full program.

PROGRAM APPROACH

The California State Public Utilities Commission (SPUC) provided the funding for this endeavor, and provided requirements and guidelines for program participation. One of the key stipulations was that qualifying facilities would have a maximum electrical demand of 20 kW. Another stipulation is that participating facilities would not be eligible for other SPUC funded programs for the work, including those sponsored through the local electricity provider, Pacific Gas and Electric (PG&E). It was also stipulated that facilities be located within the City and County of San Francisco.

It was decided that the Program would provide free analyses of lighting efficiency upgrades (audits) for qualifying facilities. Upon completion of the audit, calculations were performed to ascertain the cost and savings associated for a proposed list of lighting upgrades. Business owners who agreed to the scope of work cost and projected savings were asked for approval to implement the measures.

An implementation model was developed which involved using local Contractors to purchase materials and install lighting efficiency upgrades. Contractors were pre-qualified on the basis of a request for proposal (RFP) process that included a submittal of per unit prices for common lighting retrofit and system replacements. The submitted pricing was negotiated with each approved Contractor to create a standard price list that all participating Contractors agreed to. As part of the negotiation, the program agreed to pay Contractors a set-up fee of \$100 US for every installation. The set-up fee helped the Contractor defray fixed costs including travel and material handling, and to therefore provide more a competitive per unit price for the retrofit measures.

The City and NAA collaborated to develop an incentive program designed to lower the cost of the lighting upgrades to small business owners. The program incentive standard offer was set to provide \$200 per participating facility owner, plus 20% of the remaining construction cost. The program design stipulated that the Contractor enters into Contract with small business owners, and that the Contractor was responsible for collecting the Owner's cost share. The Program agreed to pay the Contractor the remaining fee.

Owner participation was based on receiving a signed notice to proceed for a scope of work identified by a lighting auditor that offered a return on investment through reduced lighting power requirements and energy use. The return on investment was expressed to the Owner in terms of "payback period" - the number of years required to recoup the initial investment through annual savings in electrical energy. The Program chose to present financial return in terms of this simple model in order to provide a clear expectation of results to a diverse and somewhat unsophisticated customer base.

It should be noted that the cost of electrical energy in San Francisco is high by US standards: A typical small

commercial customer buys electricity at an A-1 rate schedule, and pays an average of \$0.18 kWh (0.21 EURO/kWh) on average. These rates were used to compute the annual savings and project paybacks.

PROCESS AND TRACKING

Roles and Responsibilities

Roles and Responsibilities between the City and NAA were loosely defined and fluctuated during the course of the program. Changing responsibilities were largely due to process adjustments made in anticipation of the Full Program. General responsibilities were as follows, with the responsible parties indicated:

1. City Requirements and Services (City)
2. Marketing (City, with NAA assistance)
3. Schedule Lighting Audits (NAA)
4. Perform Lighting Audits (NAA)
5. Data Entry and Quality Control (NAA)
6. Customer Tracking Log (NAA)
7. Presentation and Follow up (NAA, with City Assistance)
8. Coordinating Contractor Walkthrough and Confirm Pricing (NAA, Contractor)
9. Scheduling and Coordinating Construction (NAA, Contractor)
10. Construction (Contractor)
11. Inspection (NAA, Contractor, City)

Work Process

The general work process was generally conducted in the following sequence:

1. Market to customer and obtain signature for notice to proceed for audit
2. Call back and schedule audit - obtain utility rate schedule and other details
3. Site Visit to perform the audit
4. Data entry of audit results
5. Site Visit to present and obtain agreement to proceed to construction
6. Site Visit with Contractor to validate job and finalize the scope of work
7. Modify job paperwork as required to reflect scope changes
8. Site Visit by Contractor to present Contract
9. Site Visit - Construction Kick Off
10. Site Visit - Construction Management Services (as required)
11. Site Visit - Conduct Inspection
12. Phone call follow-up to customer and mail Quality Service Evaluation to elicit customer feedback

The overall cycle for soliciting an audit and completing construction typically ranged from 30 to 60 days. The time required to survey the premises was usually only about 30 minutes, and the time required to construct the work typically one day. The majority of the cycle time was spent waiting for the Owner to decide whether to proceed.

Tracking

Program Tracking was accomplished by means of the following steps:

1. For every customer who returned a signed audit authorization, a customer number was assigned.
2. A paper folder was created for each customer site. The folder contained the audit authorization, utility information, site data, a print out of cost and savings calculations, and a copy of all Customer correspondence and deliverables.
3. A "Tracking" spreadsheet was developed and maintained to capture customer information and job status on an individual site and aggregate basis.
4. A "Calculation" spreadsheet was developed and maintained to enter lighting system and project data, and to generate Customer Agreement, Work Scope, and Savings Summary documents on a per Customer basis. This tool was also used to generate cost, savings, and incentive data on an aggregate basis to meet Program reporting requirements.

MARKETING

Approach

The Pilot Program was marketed in various manners:

Fliers and fax back audit authorization forms were hand delivered to businesses in several key areas with an attempt made to obtain signatures for free site audits, largely in the downtown Market and Polk Street shopping districts. Decision-makers were often not present when Program personnel initiated contact.

The Program solicited business from leads previously generated from California's "Flex Your Power" Program, primarily in the Union Street shopping district. Several of these leads resulted in signed audit authorizations; this was a fairly effective method of generating interest.

The Program gained introductions to owners with various community leaders, including members of neighborhood associations. This marketing approach resulted in several audit authorizations being signed by Customers located in the Tenderloin area.

The Program placed fax-back authorization forms as inserts with various weekly papers. There was very little response to this marketing approach.

Results

The Program materials, although informative, lacked a polished presentation. Neither lack of confidence in the City nor the materials were cited as objections to having a free energy audit conducted. Objections to continuing in the program were noted by marketers and reported to Program management. The items in the following list were cited on multiple occasions:

1. Length of lease too short to justify Owner investment,
2. Owner can't provide cash out of pocket,
3. Owner uncertainty about future of business,
4. Owner doesn't pay utilities,
5. Can't reach decision maker,

6. Payback period too long,
7. Owner does not want City electrical inspection of premises.

Recommendations

From the experiences of marketing the Pilot Program, the following recommendations were made for marketing the Full Program, and should be considered by other agencies contemplating a similar program:

1. Establish a financing program for customers with preferred (low) interest rates prior to marketing the new program,
2. Set Incentive level as high as possible, considering other Program costs,
3. Negotiate contractor pricing as low as possible while ensuring use of quality materials and workmanship,
4. Coordinate efforts with community leaders,
5. Develop Program branding and professional marketing materials,
6. Minimize the requirement for City Inspections. This is accomplished by specifying "maintenance" (lighting retrofit) work when possible rather than projects that require replacement of the light fixtures, which require a permit.

LIGHTING AUDITS

Under the Pilot Program, approval to conduct 55 lighting audits was obtained. Audits were conducted at 47 facilities. Some interested customers were not eligible for the program, while others declined to participate.

Approach

Engineers with prior experience in identifying lighting fixture upgrade opportunities conducted the Field audits. Training consisted of a mentoring approach; new auditors were paired with more experienced staff until they were judged competent to work alone. Audit practices were based on prior knowledge of lighting and cost effective lighting retrofits. Lighting retrofit strategies were selected on the basis of proven technology, focusing on capital cost measures which could be verified. The following lighting retrofit strategies were typically evaluated:

1. Replacing T-12 (1 1/2") lamps and magnetic ballasts in existing fluorescent fixtures with T-8 (1" diameter) lamps and solid state (electronic) ballasts,
2. Replacement of fluorescent fixtures with newer, more efficient fixtures,
3. Replacement of incandescent lamps with screw-based compact fluorescent lamps (CFLs),
4. Replacement of exit signs with light emitting diode (LED) source exit signs,
5. Installation of automatic lighting controls,
6. Replacement of broken or missing light fixture lenses and other low cost measures designed primarily to enhance the appearance of the lighting system.

Audits were conducted using a standard paper form (Appendix A), and the audit tool was spreadsheet based. Data entry into the spreadsheet was conducted at the office. Projects were adjusted and added as required, and the output calculations were reviewed prior to finalization. Be-

cause the data was entered off-site, there were some uncertainties regarding field conditions when projects were developed. Since the final report was not generated at the time of the survey, an additional site visit was required to present the findings.

Auditors used light meters and digital cameras to record lighting system information. Both tools were deemed essential to the job. Auditors also carried sample CFLs in order to demonstrate to potential customers the effect of proposed upgrades.

Results

Most of the audited facilities had inefficient T-12 fluorescent lamps and incandescent sources, suggesting a high potential for savings for the Full Program. The following field conditions were generally noted:

1. There is a significant amount of incandescent display lighting. We recommended reduced wattage infrared MR16, halogen, and in some cases directional compact fluorescent lighting. Where we felt that we could not adequately meet the customer needs, we eliminated these fixtures from the scope of work.
2. There is a highly differentiated need for compact fluorescent lamps: Examples include: globe shaped, candelabra, and directional lighting. We worked with vendors to establish an audit kit for use in testing and identifying optimal solutions for a range of existing cases.
3. Many businesses have refrigerated cases with non-standard lamps. Although refrigerated case lighting is typically inefficient, we were unable to cost effectively retrofit many of this fixture type due to the lack of suitable available upgrades.
4. Several facilities were noted to have substandard wiring or other electrical defects, resulting in areas being excluded from the work.

Recommendations

The spreadsheet audit tool provided for ease of development and reconfiguration, which worked for the pilot. A database driven tool would afford more consistency, and is recommended for the "Full Program".

Require the following of lighting auditors in the Full Program:

1. Participation in formal training and adherence to audit standards.
2. Bring a standard array of compact fluorescent samples to the customer site when the intake information indicates incandescent lamps are currently in use.
3. Record light levels and take digital photographs of unusual applications.
4. Combine Audit and Sales Presentation into single site visit (refer to following section).

SALES PRESENTATIONS

Approach

The Program presented 42 audit results, and were unable to schedule presentations with the Owners of the 5 remaining businesses. Fifteen agreements to perform retrofit work were obtained, with one Owner later declining to participate.

Generally, those who conducted the audit have made presentations. In many cases, City personnel have made additional presentations and increased the incentive offer in an effort to obtain an agreement to proceed.

Results

Objections to continuing in the program were noted by sales presenters and reported to Program management. The items in the following list were cited on multiple occasions:

1. Project was more costly than expected.
2. Customer does not want or can't pay out of pocket.
3. Customer is unsure of business future/does not want to invest in business.
4. Customer too busy.
5. Customer is not decision maker.

Without Program incentives, the payback periods for the completed work, including all scope changes, range from 2.1 to 9.2 years. The average simple payback for all completed work with no incentives was calculated at 3.0 years. With the standard incentive offer included (\$200 per participating facility, plus 20% of the remaining construction cost) the projected payback periods would have ranged from immediate to 4.3 years for completed work, or 2.4 years on average.

An internal debate arose as to whether the Program should increase the incentive offer in order to increase participation in the program. It was decided to offer additional incentives and program sponsored financing in order to achieve more participation.

Table 1 indicates the cost, savings, and incentive data for each completed site. The cost and savings associated with the initial scope of work and the as-built conditions are included. The simple payback period for completed work ranged from immediate to 4.0 years, based on the actual cost to the customer. The average simple payback was calculated at 1.9 years.

Recommendations

The following are recommended practices for presenting customers with lighting efficiency proposals in the Full Program, and should be considered by other agencies contemplating a similar program:

1. Schedule appointments with the understanding that a proposal will be provided to the Owner at the time of the audit.
2. Prepare audit staff to present results in real time directly following the audit, when possible. This will entail equipping auditors with a portable computer, lighting au-

dit software program, printer, cable, and paper, in addition to the standard audit tools.

3. Require the audit software program to include a cash flow projection report to the customer if they elect to use a financing program.

4. Mandate follow on site visits as required to present the offer for a second decision-maker, to provide additional samples for consideration, or otherwise as required to obtain an authorizing signature for construction.

CONTRACTOR MANAGEMENT AND CONSTRUCTION

Of the 14 sites where construction has been agreed to, 13 have been constructed, and 1 was pending completion as of April 1, 2002.

Approach

NAA issued an RFP to local Contractors with the aim of selecting two Contractors to provide turnkey installation services. Per-unit pricing for lighting retrofit activities, plus adders for site conditions was solicited. Prices were then negotiated into a standard list for use in the pilot, and two Contractors were selected to participate. These processes have worked relatively well, as most of the actual measures had been anticipated and were priced in advance.

The implementation plan involved scheduling work by location in order to optimize contractor and program resources. Due to the small numbers of signed customers, this notion of centralizing the work by location has not been practical for the pilot.

The City made a determination which type of work requires City electrical system inspections and permits, and which do not. These parameters were communicated with the Contractors and with the customers.

The Contractor scheduled the work scope validation and construction activities. There were some miscommunications with this process in terms of coordination. Better coordination will be required for the full program. Scheduling should be by mutual agreement between Program staff and the Contractor.

Results

Of the 13 projects constructed, nearly all underwent some minor scope changes at the time of the Contractor walkthrough. Typical minor scope changes included:

1. Elimination from scope of fixtures determined by the Contractor to be in unusable or unsafe condition.
2. Additions or deletions from scope due to auditor miscounts or misidentification of light fixtures.
3. Customer driven scope changes to add or subtract work.
4. Substitution of one form of compact fluorescent lamp for another, usually to more closely match existing light output or fixture configuration.
5. Change in ballast or lamp specification, typically based on need for more light output or for adjustment in lamp color.

The most common constructed retrofits involved upgrading fixtures to use T-8 lamps, followed by the installa-

tion of compact fluorescent lamps. Several Owners requested new light fixture lenses in order to improve the appearance of the premises. No lighting controls were installed in the pilot program, as they did not appear to be cost effective investments from the customer perspective.

Three of the completed jobs required changes (change orders) after Construction had been completed, resulting in a greater expense for the project than was originally anticipated. The Program paid for all of these additional costs.

Four of the completed installations are characterized as Case Studies and detailed following the Program Summary. The Case Studies include the three projects where change orders were to achieve customer satisfaction.

Post-installation inspections were conducted in order to assess the quality of installation, and to elicit customer feedback. A Quality Service Evaluation (QSE) survey form was sent to each Owner for whom a site had been completed. As of April 1, 2002, five completed QSE forms had been returned, with generally favorable results.

Recommendations

In order to avoid scope changes prior to construction, and change orders after the fact, it is recommended that audit standards and application engineering approaches be reviewed and accepted by Contractors. To the extent that Contractors can participate in the audit phase, there will be fewer changes to the scope of work, and a smoother transition from audit to implementation.

PROGRAM SUMMARY

The table below (next page) indicates the following projects that had been constructed by April 1, 2002, with one project pending completion.

CASE STUDIES

The following four case studies are presented primarily for the lessons learned:

Daldas Grocery

Existing Conditions: Dalda's Grocery is a convenience store. The existing lighting system in the main store and stocking areas consisted mainly of fluorescent fixtures with eight-foot lamps. Fixtures were surface mounted on a hard ceiling. A second "T-bar" ceiling consisting of a suspension system and ceiling tiles had been installed below the hard ceiling, incorporating clear prismatic plastic panels in order to permit the light from the fixtures above to pass through and illuminate the premises. This "luminous ceiling" is an inherently inefficient design as the ceiling tiles block a portion of the fixture light output.

Lighting Upgrade Strategy: A project was developed to remove the surface mounted fixtures and lenses from the hard ceiling, and to install new three-lamp fixtures with T8 lamps recessed into the T-bar ceiling. The project specified new ceiling tiles to replace the existing plastic lenses. The fixture replacement upgrade strategy afforded a large reduction in connected lighting load. The risk of this ap-

Table 1: Lighting Project Cost and Energy Savings

Site	Estimated, Presented, & Negotiated						As-Built Conditions							
	Total Projected Cost	Cost Reduced by Standard Offer	Cost As Negotiated with Customer	Annual Savings Estimate	Pay-back (years) (1)	kW Saved	Total Job Cost	Total Cost to Customer	Job Cost Borne By Program	Annual Savings (\$)	Annual Savings (kWh)	Pay-back (years) (2)	kW Saved	Program Cost per kW saved
Daldas	\$ 4 953	\$ 3 802	\$ 3 802	\$ 2 748	1,4	2,7	\$ 5 495	\$ 3 802	\$ 1 693	\$ 2 321	14 128	1,6	2,3	\$ 736
Civic Center Market	\$ 2 242	\$ 1 634	\$ 1 634	\$ 512	3,2	0,9	\$ 2 407	\$ 1 634	\$ 773	\$ 408	2 193	4,0	0,8	\$ 966
Artisans (3)	\$ 1 554	\$ 1 083	\$ 658	\$ 658	1,0	0,9	\$ 1 790	\$ 658	\$ 1 132	\$ 710	3 669	0,9	0,9	\$ 1 258
Great Frame Up (3,4)	\$ 2 050	\$ 1 480	\$ 775	\$ 833	0,9	1,3	\$ 2 050	\$ 775	\$ 1 275	\$ 964	4 983	0,8	1,4	\$ 911
Beauty Network (3,4)	\$ 1 649	\$ 1 159	\$ 600	\$ 695	0,9	1,3	\$ 2 590	\$ 600	\$ 1 990	\$ 468	2 405	1,3	1,0	\$ 1 990
Party Animal (3)	\$ 899	\$ 559	\$ 280	\$ 154	1,8	0,4	\$ 899	\$ 280	\$ 619	\$ 154	790	1,8	0,4	\$ 1 548
New Beauty (3)	\$ 799	\$ 479	\$ 299	\$ 329	0,9	0,5	\$ 799	\$ 299	\$ 500	\$ 329	1 694	0,9	0,5	\$ 1 000
Green Apple Books (5)	\$ 9 314	\$ 7 291	\$ 7 376	\$ 3 330	2,2	3,5	\$ 9 314	\$ 7 376	\$ 1 938	\$ 3 330	17 178	2,2	3,5	\$ 554
Society of Friends (6)	\$ 8 484	\$ 6 627	\$ 6 627	\$ 2 066	3,2	5,4	\$ 8 146	\$ 6 338	\$ 1 808	\$ 1 958	12 382	3,2	6,8	\$ 266
Clement Mini Mkt (4,6)	\$ 1 268	\$ 854	\$ 854	\$ 402	2,1	0,5	\$ 1 574	\$ 1 099	\$ 475	\$ 542	2 902	2,0	0,6	\$ 792
Cal Insurance (6)	\$ 4 329	\$ 3 303	\$ 3 303	\$ 1 698	1,9	2,4	\$ 3 679	\$ 2 783	\$ 896	\$ 1 703	10 360	1,6	1,0	\$ 896
Glamour Fine Jewelry	\$ 197	\$ (2)	-	\$ 63	0,0	0,2	\$ 156	-	\$ 156	\$ 17	90	0,0	0,1	\$ 1 560
One Half (3)	\$ 3 042	\$ 2 274	\$ 1 303	\$ 1 303	1,0	2,7	\$ 3 042	\$ 1 303	\$ 1 739	\$ 1 303	6 732	1,0	2,7	\$ 644
Totals:	\$ 40 780	\$ 30 543	\$ 27 511	\$ 14 791	1,9	22,7	\$ 41 941	\$ 26 947	\$ 14 994	\$ 14 207	79 506	1,9	22,0	\$ 682

- 1 Payback computed based on Negotiated Cost / Annual Savings Estimate
- 2 Payback computed based on Total Cost to Customer / Annual Savings
- 3 For selected sites, the City Program Administrator negotiated the Customer cost based on an increased incentive rate.
- 4 For selected sites, the City Program Administrator provided financing for the Customer portion at 0% interest.
- 5 This site had agreed to construction with a non-program contractor. A slightly reduced incentive payment was negotiated as a means of helping the customer cover the cost of some additional work identified by a Program lighting auditor.
- 6 Work for these sites underwent major scope changes between presentation and job completion.

proach was that the proposed lighting system was completely different from the system that the customer was accustomed to. Additional work included the replacement of incandescent lamps with compact fluorescent lamps, and the retrofit of existing fixtures in the restroom and basement storage to use T-8 lamps.

Sales Process: The Customer was initially presented with a cost of \$3,802 and an annual saving of \$2,748. The presentation was based on the standard incentive offer, which the customer accepted.

Implementation Issues and Resolution: Due to the condition of the ceiling, it was not possible to remove all the existing fixtures. New fixtures had to be installed in alternate locations. After the job was completed, the customer indicated that areas of the main part of the store were too dark, including the area near the cash register. Overall, the store

was illuminated to a higher level than prior to implementation, however, due to the fixture spacing and shadowing caused by merchandise in the aisles, there were sections where measured light levels had decreased. To compensate for the dark areas, two additional fixtures were installed in the main area, and one of the existing eight foot fixtures above the suspended ceiling was retained and relamped with high lumen lamps, and refitted with new lenses. Other work remained as specified. The cost for the additional work was borne by the program. The customer was satisfied with the resolution. The primary customer re-enforcement was the importance of consistent light levels, particularly near the cash register.

Great Frame Up

Existing Conditions: The Great Frame Up is a picture framing shop consisting of work shop and display areas. The work areas were illuminated primarily with eight-foot fluorescent lamps, although one the lighting for one framing table was provided by suspended fixtures containing globe shaped incandescent lamps. The display lighting was provided by incandescent track lighting. Six-foot fluorescent fixtures attached to the canopy, although they were identified as eight-foot fixtures during the audit.

Lighting Upgrade Strategy: A project was developed to retrofit the eight-foot fluorescent fixture to use four-foot lamps, including those located outside. Compact fluorescent globes were specified to replace the incandescent globes. It was decided that no suitable replacement was available to replace the specialty quartz wall washing fixtures. The strategy for the 60 W halogen track mounted fixtures was to replace them with 14W compact fluorescent lamps with polished metal sleeves to direct the light towards the wall.

Sales Presentation: The Customer was presented based on the standard incentive offer at a cost of \$1,480 and annual savings of \$833. The negotiated cost was reduced to \$775, with a portion of that cost financed.

Implementation Issues and Resolution: Due to previously encountered difficulties retrofitting eight-foot fixtures to use four-foot lamps, it was decided at the Contractor walk to adjust the scope of work to install eight-foot T8 lamps. A small work bench fixture was eliminated from the scope because it was a plug in type, and the cord presented a possible hazard. The Contractor judged the exterior fixtures to be in unsafe condition and inappropriately mounted. The scope of work was revised to install new compact fluorescent flood-light fixtures in the entryway to illuminate the canopy. Overall, the customer was satisfied with the quality, direction, and quantity of illumination following the job. No additional work was required. As a result of lessons learned at previous sites, we changed the scope of work to permit the use of eight-foot T-8 lamps prior to construction. We relied on our unit price schedule to negotiate the final cost and savings with the contractor. We agreed with the Contractor that the cost difference between the initial and revised scopes of work was minor enough that we did not change the price in spite of the various scope changes identified at the walkthrough.

Civic Center Market

Existing Conditions: Civic Center Market is a convenience store featuring food and liquor items for sale. The existing lighting system in the main store consisted mainly of fluorescent strip fixtures with bare six-foot and eight-foot lamps. Fixtures were surface mounted. T-8 lamps are not available in six-foot lengths, and four-foot T-8 lamps are less expensive and easier to handle than eight foot T-8 lamps.

Lighting Upgrade Strategy: A project was developed to retrofit the eight-foot fixtures with new sockets to use (4) four-foot fluorescent lamps, and to remove the six-foot fixtures. New four-foot fluorescent fixtures with acrylic

prismatic wraparound lenses were specified to replace the six-foot fixtures in the front of the store, however, no replacement fixture was indicated for the six-foot fixture in the back of the sales area. Additional work included the replacement of incandescent lamps with compact fluorescent lamps.

Sales Presentation: The Customer was presented with a cost of \$1,634 and an annual saving of \$512. The presentation was based on the standard incentive offer, which the customer accepted.

Implementation Issues and Resolution: The Contractor found it very difficult to retrofit the eight-foot fixtures due to the condition and construction of the existing fixtures. He elected to install new eight-foot strip fixtures, each containing (4) four-foot lamps. Where six-foot fixtures had been replaced with four-foot fixtures, the Customer indicated that light levels were not adequate. The customer reported low light levels in the rear of the store as well, where the six-foot fixture had been removed. Overall, the store was illuminated to a higher level than prior to implementation, however, light levels had decreased in the back of the sales area. The light levels near the front of the store had actually increased, in contrast to the customer report. To compensate for the dark areas, one three-lamp, four foot fluorescent fixture was installed in the back area, and two of the three new four foot, two lamp fixtures were relamped with high lumen lamps and a high ballast factor ballast. Other work remained as specified. The cost for the additional work was borne by the program. The customer was satisfied with the resolution. The primary customer reinforcement was the importance of maintaining light levels, particularly near the cash register and security mirror. Based on the difficulty of converting the fixtures to use four-foot lamps, the retrofit strategy was abandoned in favor of relamping eight-foot fixtures with eight-foot T-8 lamps, even though the eight-foot lamps are significantly more costly than four foot T-8 lamps.

Beauty Network

Existing Conditions: Beauty Network is a beauty salon and sales area featuring beauty products. The salon areas are illuminated by a combination of low voltage (MR16) track fixtures, and fluorescent sources. Lighting for the sales area was provided by recessed, lensed fluorescent fixtures containing F40 40W cool white fluorescent lamps. The exterior lighting was provided by incandescent PAR lamps.

Lighting Upgrade Strategy: An elementary upgrade strategy was developed to replace four-foot fluorescent lamps on a one for one basis throughout the facility. The exterior lighting was originally identified for a screw-based fluorescent replacement, however, at the Contractor walkthrough, a wet location unit was specified.

Sales Presentation: The Customer was presented based on the standard incentive offer at a cost of \$1,159 and annual savings of \$695. The negotiated cost for the work was reduced to \$600, with a portion of that cost financed.

Implementation Issues and Resolution: Due to the warm color tones of the wall covering in the sales area, a lamp

color of 3500 K was selected for the replacement lamps, instead of recommending 4100 K temperature, which would have more closely matched the existing cool white lamps. The customer was unhappy with the warm tones, and requested much brighter lamps be installed to match the existing case. At the Program's direction, the Contractor installed high lumen output (800 series) T-8 lamps at a color temperature of 4100K. Standard output ballasts were also installed. The Customer continued to be unhappy as he judged the light levels to be inadequate. The Contractor scheduled a return visit in order to remove the standard output ballasts and install new, high light output ballasts in the sales area. This approach resulted in light levels far exceeding the existing case. The customer was satisfied with the resolution. It seemed that the customer "wanted what he had, only more of it". The energy and power reduction associated with the project was secondary to having an improved lighting system.

CONCLUSION

The Pilot Program for Small Business Light Retrofits served its purpose in laying the foundation for the larger, Full Program currently underway in San Francisco. This section summarizes the lessons gathered from the experience.

Customer referrals have been the basis for a large number of the initial leads generated to date for the Full Program. From this it can be inferred that customer satisfaction should be a top priority for any program serving as a pilot to a larger program of this type. Customer satisfaction, in the case of the pilot program, came with a financial cost for increased incentives, interest-free loans, customized measures, multiple site visits, and project change orders. These enhancements were required to offset the inefficiencies of Program startup, spreadsheet-based audit calculation and reporting processes, and relatively high installation pricing.

The average expenditure of \$682 per kW saved was calculated based on the ~\$15,000 paid from the program directly to the Contractors as incentives, and does not include the additional ~\$185,000 which was required to administer the program. Organizations considering an investment in a similar program will need to consider the marketing, auditing, engineering, managing and reporting costs when developing a budget for the activity.

Organizations contemplating a large lighting retrofit program of this type are advised to start by developing a pilot program, and to expect to incur a high financial cost, whether measured on a per site basis or by total kW reduced. While it can be expected that a pilot program of this type will be costly, it is essential that a fully functional, large-scale program be cost effective. Organizations are encouraged to review the following suggestions when developing lighting retrofit programs of this type:

1. Set an incentive level that is competitive with other incentive offers, and provides an attractive return on investment. In the Pilot program, the customer's average simple payback period for constructed sites was 1.9 years.

2. Market through word of mouth, leveraging successful installations. Several of the participating Pilot businesses were offered increased incentive levels if they would hold "Open Houses", during which Program staff market the program to other businesses.

3. Identify a set of standard lighting retrofit practices and a standardized tool for collecting, processing, and processing field audit data. During the transition to the Full Program, staff has identified "best practices" retrofit strategies based on a cost/kW saved criteria. A database driven lighting audit tool has been customized for the Full Program, and investments have been made in a pen-based computer and portable printer to provide for immediate delivery results to the Customer.

4. Negotiate pricing and terms with Contractors to minimize the installation cost. In anticipation of the volume of work associated with the Full Program, Contractors have been willing to reduce the unit cost associated with performing many standard lighting retrofits.

The summary recommendation to prospective program administrators is to first develop a pilot program. Use the pilot to learn about the market, the customer, the contractors, the tools, and the processes associated with developing a lighting retrofit program for small businesses. Incorporate the lessons learned into the development of a successful, cost-effective large scale Program.