

Phase I Ex Ante Review Findings

Table 1-1: Project Information

IOU	PG&E
Application ID	2K13175623
Application Date	04/22/2013
Program ID	PGE21011
Program Name	Commercial Calculated Incentives
Program Year	2013
Itron Project ID	X356
IOU Ex Ante Savings Date	TBD
ED Measure Name	Interior and Exterior LED Lighting Retrofits
Project Description	Replace linear fluorescent lighting systems, T8 and T5, with LED lighting systems in a distribution warehouse.
Date of ED Review(s)	06/23/2013
Primary Reviewer / Firm	Leonel Campoy / Itron
Review Supervisor / Firm	Joseph Ball / Itron
ED Project Manager	██████████ / California Public Utilities Commission, Energy Division
ED Policy Authorization (as needed)	
Type of Review (Desk, On-site, Full M&V, Tool)	Desk
ED Recommendation	Project is conditionally approved pending submittal of supporting evidence for the annual operating hours, post-implementation verification, and final savings true-up.

Measure Description

The project will remove existing T8 and T5 lighting systems, both high and low bay fixtures, replacing them with LED lighting in a large distribution warehouse.

Summary of Review

Pacific Gas & Electric (PG&E), the investor owned utility (IOU), submitted the following documents in response to Data Request (DR) 4818 for this Phase I Ex Ante Review:

- Transmittal Memorandum for DR 4818;
- Project Sponsor Submitted Savings Calculations (Workbook Attachment 1);
- Manufacturer Specifications for the LED Lighting Systems (PDF Attachment 2);
- PA Approved Energy Savings Calculations (Workbook Attachment 3);
- Email Messages and Phone Logs (PDF Attachment 4);
- HVAC Interactive Effects (IE) Calculations (Workbook Attachment 5); and
- PA Review and Incentive Application (Workbook).

The ex ante review focused on verifying the assumptions and calculations contained within the PA approved energy savings workbook. PG&E indicates that the lighting retrofits are an Early Retirement (ER) project. Hence, a dual-baseline applies to the project with the in-situ equipment serving as the baseline for the remaining useful life (RUL) of the existing fixtures (RUL Period), and Title 24 requirements for the period following the end of the existing equipment RUL through the end of the effective useful life (EUL) of the proposed measure equipment (RUL through EUL Period). According to the PA Approved workbook, close to 90% of the indoor fixtures will be replaced throughout the facility, indicating that the Title 24 lighting alteration requirements apply.

The IOU staff performed a preliminary Lighting Power Density (LPD) calculation for five of the facility's indoor areas: Area 100/200, Areas A through C, and the Aerosol Room. The "Approved Calcs" spreadsheet tab in the submitted PA Approved Energy Savings Calculations workbook lists 12 facility areas and the Aerosol Room is not listed among them. ED compared the demand values used in the LPD analysis to the area subtotals in the "Approved Calcs" spreadsheet tab and found only one value that matched. PG&E determined that the existing area LPD values are less than the 2008 Title 24 maximum allowed area category LPD values, and therefore, the existing indoor lighting fixtures should be used as the baselines for both the RUL period and RUL through EUL periods. After correcting the demand values in the LPD analysis using the data in the "Approved Calcs" spreadsheet, ED concurs that existing fixtures should be used as the baselines to avoid regressive baselines since the existing LPD values remained lower than the Title 24 requirements. PG&E did not provide an analysis of LPD requirements for the outdoor lighting replacements, but since it appears that all outdoor fixtures are being replaced

with lower demand equipment and the baselines are often regressive for outdoor lighting, using the existing T8 equipment as the baseline is acceptable.

The ED review verified all the selected baseline fixture wattages against the recommended list of fixture wattages found in the Modified Lighting Calculator tool, Version 3.1. ED found the selected fixture Wattages acceptable compared to the 2011 DEER code baseline fixtures in the tool. Close to 86% of the indoor lighting fixtures are claimed to operate 24 hours per day with a fraction of the existing high bay fixtures (1,026) already controlled with occupancy sensors. These same fixtures are assumed to continue to be controlled with occupancy sensors. PG&E uses the 2011 DEER recommended 16% hours of use reduction factor for all indoor occupancy sensor controls. Since the lighting controls are pre-existing, there is no net impact. The PA Review does not indicate whether additional occupancy sensor controls will be installed in those indoor areas that currently have no lighting controls and that operate less than 24 hours per day.

The source and derivation of the lighting fixture annual operating hours was not provided. If an Energy Management System (EMS) is used to control the facility lighting circuits, current computer screen snapshots of the lighting schedules should be collected and correlated to the fixtures listed in the PA Approved workbook. The PA Approved workbook has flagged three percent of the fixture operating hours with a yellow background. All of the yellow highlighted rows assume 8,760 hours with the exception of one office area with 3,066 hours. Based on the assigned Usage Group for these rows, ED believes that the hours of use for these line items are very likely overstated and should be verified and corrected as needed. There appears to be additional areas that are very likely space conditioned besides the “Areas 100/200.” These areas should be confirmed and added to the indirect HVAC impacts as necessary. Lastly, all areas with less than 24 hours per day operation should use DEER coincidence demand factors (CDF) in the peak demand reduction impacts. Those considered as “small office” areas should use a 0.69 CDF value and all others considered “unconditioned storage” areas should use a 0.70 CDF value. All indoor 24 hour per day operations default to a 1.0 CDF value and all exterior lighting should have a zero CDF value. The IOU should consolidate all the savings calculation spreadsheets into a single workbook. Finally, when ED examined the line item measure costs, it became apparent that the unit costs for the proposed LED fixtures are very inconsistent.

Review Conclusion

The project is conditionally approved pending submittal of supporting evidence for the annual operating hours, post-implementation verification of the retrofits, and final savings true-up to the verified measure installations.

Summary of ED Requested Action by the IOU

ED requests that PG&E undertake the following steps and submit the requested information once the project implementation has taken place and the lighting retrofits verified:

1. Title 24 requires that altered lighting systems that operate less than 24 hours per day should include mandated lighting controls. For the indoor areas that are listed in the PA Approved calculations workbook that currently indicate there are no lighting controls, such as in offices, rest rooms, break rooms etc., document whether a Title 24 compliant lighting control already exists such as an EMS or time clock, or whether lighting controls will be added to those areas to comply with Title 24.
2. Provide final project and measure costs based on itemized contractor invoices. The costs should be segregated between labor, material, and disposal costs. For the fixture removal line items in the PA Approved calculations workbook, the measure costs should reflect at least labor and disposal costs.
3. Provide incremental project and measure costs for the RUL through EUL period that conforms to the prior guidance given in D.12-05-015 (see the ED recommendation for Project Cost Basis in Table 1-2).
4. The PA Approved calculations workbook had flagged several rows of annual operating hours with a yellow background. These annual operating hours appear to be overstated for the identified Usage Group for these particular fixtures. PG&E should verify and revise the annual operating hours for those line items as needed.
5. Submit documentation that supports and shows the derivation of the annual operating hours for the lighting fixtures since they are significantly higher than the default hours in the 2011 DEER. If an EMS controls the lighting circuits, provide current computer screenshots of the lighting schedules correlated to the line items in the PA Approved calculations workbook.
6. Provide EUL and RUL values for each measure line item in the PA Approved calculations workbook and determine the overall average EUL and RUL for the interior and exterior measures.
7. Revise the savings calculations to include additional areas that may be space conditioned and incorporate CDF values into the calculation of all lighting fixtures as outlined in the ED recommendation on Calculation Methods/Tool Review in Table 1-2.
8. Provide a single consolidated workbook with the savings calculations trued-up to the final verified lighting fixture removals and replacements.

Table 1-2 Review Findings

Reviewed Parameter	Analysis
<p>Project Baseline Type (Early Replacement, Normal Replacement, Capacity Expansion, New Construction, System Optimization, Add-on Measures) Note: For early retirement projects only, include RUL through EUL baseline)</p>	IOU Proposal: Early Retirement
	ED Assessment: Acceptable
	ED Recommendation: None
<p>Project Baseline Technology (in situ equipment, Title 24 (specify year), other code or other efficiency level (specify), industry standard practice - ISP)</p>	IOU Proposal: In-situ lighting fixtures for both the RUL and RUL through EUL periods due to regressive Title 24 LPD baselines.
	ED Assessment: The in-situ T8 and T5 lighting systems are acceptable as the baseline for the RUL period. The PA approved savings workbook provides an area category LPD analysis and concluded that the existing area LPD values are lower than the Title 24 maximum allowed area category LPD values. Hence, the in-situ equipment is used as the baseline for the RUL through EUL period to avoid regressive baselines. ED corrected the demand values used in the LPD analysis and the conclusion remains valid. ED verified the baseline lighting fixtures and wattages against the DEER 2011 code baselines found in the PG&E Modified Lighting Calculator v3.1 and found them acceptable. One minor typographical error was identified: the correct fixture code for the F54T5/HO fixture is F44PHL/2 and not F44PL/2.
	ED Recommendation: Correct the minor typographical error for the F54T5/HO fixture code.
<p>Project Cost Basis (Full Incremental, or Both. Note: For early retirement projects, include RUL through EUL cost basis treatment)</p>	IOU Proposal: Preliminary full project cost estimate of \$187,972.68.
	<p>ED Assessment: The PA Approved calculations spreadsheet provides preliminary cost estimates for each replacement fixture line item except for the removed fixtures. The cost estimates are not broken down into labor, disposal, and material costs. The fixture removals should at least reflect labor and disposal costs. The proposed cost treatment for the RUL through EUL period was not provided.</p> <p>ED found that the LED fixture kits unit cost are very inconsistent. For example, all the 2 x 25W LED Kits measure costs are based on a unit cost of \$3.05 per kit. Yet the 25W LED Kits indicate unit costs of either \$41.15 or \$12.19. The 50W LED Kit unit cost is \$77.74. Likewise, there are six different unit costs used for the “LED Hi Bay Sensored” fixtures that vary from a low of \$79.29 to a high of \$277.41 while the “LED Hi Bay No Sensor” unit cost either is \$114.32, \$96.84, or \$30.48. The LED Troffer has a unit cost of either \$18.29 or \$96.03. Lastly, the LED Wall Pack uses a single unit cost of \$32.01. These unit costs are not in line with observed market pricing.</p>

Reviewed Parameter	Analysis
	<p>ED Recommendation: Upon project completion, use itemized contractor invoices to finalize both the project and measures costs broken down into detailed categories such labor, materials, disposal, etc. ED will closely review the submitted unit costs for consistency. For the RUL through EUL period, prior guidance in D.12-05-015 indicated that "...the measure or project cost utilized in an early-retirement case is the full cost incurred to install the new high-efficiency measure or project, reduced by the net present value of the full cost that would have been incurred to install the standard efficiency second baseline equipment at the end of the remaining useful-life period. Thus, the early-retirement cost is higher than the incremental cost used in a replace-on-burnout or normal-replacement case, only by the time value of the dollar amount of the standard equipment full installed cost, using our adopted cost-effectiveness discount rate to calculate that time valuation."</p>
<p>RUL (required for early retirement projects only, otherwise N/A)</p>	<p>IOU Proposal: Not Provided</p>
	<p>ED Assessment: The RUL of the in-situ linear fluorescent equipment is not given in the submitted PA review documentation. Based on the currently claimed annual operating hours, ED estimates that the RUL values vary between 1.9 to 5 years.</p>
	<p>ED Recommendation: ED recommends that PG&E use the default DEER methodology of one third of the measure calculated EUL for each measure line item to determine the individual line item RUL values and overall Average RUL values for the interior and exterior measures.</p>
<p>EUL (for each measure)</p>	<p>IOU Proposal: Not Provided</p>
	<p>ED Assessment: The measure EUL values are not provided in neither the PA review document nor calculated in the PA Approved savings calculations. Based on the currently claimed annual operating hours, ED estimates that the measure EUL values vary between 5.7 to 15 years.</p>
	<p>ED Recommendation: ED recommends that PG&E estimate the EUL values for each line item using the DEER calculation methodology: minimum of either 15 years or 50,000 hour service life for the LED systems as indicated in the submitted spec sheets divided by each line item annual operating hours. If the measure will have occupancy sensor controls, the annual operating hours should be reduced accordingly.</p>
<p>Savings Assumptions</p>	<p>IOU Proposal: Use the in-situ lighting fixtures for both the RUL and the RUL through EUL periods along with site specific annual operating hours for each area and fixture line item in the PA Approved savings workbook.</p>
	<p>ED Assessment: The code baseline fixture wattages used were verified against the recommended values in the Modified Lighting Calculator v3.1 workbook and are acceptable. The annual operating hours are self-reported and the documentation does not elaborate on either their source or derivation. The claimed annual operating hours exceed the DEER operating hours for both the unconditioned storage and small office building types. Only the hours of use for the exterior lights controlled with photocells use default DEER operating hours.</p>

Reviewed Parameter	Analysis
	<p>ED Recommendation: The source and derivation of the self-reported operating hours should be provided for ED review. The PA Approved calculations workbook indicates that about 86% the 4,644 lighting fixtures are turned-on continuously year-round, including holidays. If a building energy management system (EMS) exists, current screenshots of the lighting schedules should be used to document and collaborate the operating hours for each area. The PA Approved calculation workbook has flagged three percent of the fixture’s hours of use with a yellow background. All of the yellow highlighted rows use 8,760 hours with the exception of one office area with 3,066 hours. Based on the assigned Usage Group for these rows, ED believes that the hours of use for these line items are very likely overstated and should be verified and corrected as needed.</p>
<p>Calculation Methods/Tool Review</p>	<p>IOU Proposal: The IOU uses engineering calculations in separate workbooks.</p>
	<p>ED Assessment: Acceptable</p>
	<p>ED Recommendation: ED observed several additional areas in the PA Approved calculations workbook, such as offices, break rooms, guardhouses, and rest rooms, that may be space conditioned besides those designated as “Areas 100/200.” These additional areas should be confirmed and added to the indirect HVAC impacts if necessary. In addition, all areas with less than 24 hours per day operation should use DEER coincidence demand factors (CDF) in the peak demand reduction impacts. Those considered as “small office” areas should use a 0.69 CDF value and all others considered “unconditioned storage” areas should use a 0.70 CDF value. All 24 hour per day operations default to a 1.0 CDF value and all exterior lighting should have a zero CDF value. The IOU should consolidate all the calculation spreadsheets into a single workbook.</p>
<p>Pre- or Post-Installation M&V Plan</p>	<p>IOU Proposal: Not Provided</p>
	<p>ED Assessment: The documentation provides neither a post-implementation M&V plan nor an inspection plan.</p>
	<p>ED Recommendation: The IOU should verify the self-reported annual operating hours through data collection and/or verifying the lighting schedules through the existing EMS, time clocks, etc., if available.</p>
<p>Net-to-Gross Review</p>	<p>IOU Proposal: Not Provided</p>
	<p>ED Assessment: An NTG assessment is warranted.</p>
	<p>ED Recommendation: An NTG interview is recommended.</p>

Table 1-3 Energy Savings Summary

Description	IOU Ex Ante Claim	ED Recommendations
First Year kWh Savings	1,265,651 kWh (direct lighting impacts) and 12,057 kWh (indirect HVAC IE impacts)	TBD
First Year Peak kW Savings	153.9 kW (direct lighting impacts) and 3.3 kW (indirect HVAC IE impacts)	TBD
First Year Therms Savings	-57 Therms	TBD
kWh Savings (RUL Period)	1,265,651 kWh (direct lighting impacts) and 12,057 kWh (indirect HVAC IE impacts)	TBD
Peak kW Savings (RUL Period)	153.9 kW (direct lighting impacts) and 3.3 kW (indirect HVAC IE impacts)	TBD
Therms Impact (RUL Period)	-57 Therms	TBD
kWh Savings (RUL thru EUL Period)	1,265,651 kWh (direct lighting impacts) and 12,057 kWh (indirect HVAC IE impacts)	TBD
Peak kW Savings (RUL thru EUL Period)	153.9 kW (direct lighting impacts) and 3.3 kW (indirect HVAC IE impacts)	TBD
Therms Savings (RUL thru EUL Period)	-57 Therms	TBD
Annual Non-IOU Fuel Impact (RUL Period)	N/A	N/A
Annual Non-IOU Fuel Impact (RUL thru EUL Period)	N/A	N/A