

Appendix C

Energy Savings Measurement and Incentive Payments

The Residential/Small Commercial SOP offers three measurement and verification (M&V) options that can be used for determining energy savings and incentive payments.

The first of these options is referred to as the “Deemed Savings Option.” This option provides pre-determined energy savings amounts for most of the common energy-efficiency measures. These deemed savings values have been approved by the PUCT. (For a listing of these savings values, refer to Appendix B.) This option allows for incentive payments that are more predictable and require fewer administrative resources.

The second option is the Simplified M&V Option for Commercial and Industrial (C&I) Lighting Retrofits. Under this approach, savings are based on engineering calculations using typical equipment characteristics and operating schedules developed for particular applications. Project measures must meet certain criteria in order to calculate their resulting energy savings using the Simplified M&V Option.

The third option is referred to as the “Measured Savings Option.” With this option, actual measurements and analysis are relied upon to calculate energy savings. This option may provide more accurate savings measurements, but will also add to both Project Sponsor’s and to HL&P’s administrative costs. Project Sponsors selecting this option must submit an M&V plan with their Project Application. All proposed M&V plans must be approved by HL&P before any measures may be installed. In addition, if HL&P, in its sole judgment, determines that its own administrative costs would be substantially increased as a result of Project Sponsor’s proposed M&V plan, it has the option of charging the Project Sponsor for these incremental administrative costs.

During the development of the Project Application, the Project Sponsor must specify which M&V option is going to be utilized. Once the M&V option is selected, the Project Sponsor must adhere to this process throughout the entire term of the SOP Agreement. However, the Project Sponsor may request the M&V option be changed from the Measured Savings option to the Deemed Savings option within the first three months of the Project Implementation Period.

The payments calculated below may be adjusted based on results of HL&P's site inspection results as described elsewhere in this document and in the SOP Agreement.

Deemed Savings Option

If the project consists of energy efficiency measures for which deemed savings have been approved by the Commission and the Project Sponsor wishes to be paid entirely on the basis of these deemed savings values, then the Project Sponsor is eligible to receive 100% of deemed savings incentive payments within 45 days after submitting a monthly implementation report and invoice, subject to HL&P's on-site inspection results.

Chapter Three of this Manual describes the process for submitting Project Implementation Reports, documentation, and invoices.

Simplified M&V for C&I Lighting Retrofits

If the project consists of lighting retrofits which conform to the Simplified Guidelines for C&I Lighting Retrofits, and the Project Sponsor wishes to be paid on the basis of savings values calculated as per this procedure, then the Project Sponsor is eligible to receive 100% of savings incentive payments within 45 days after submitting a monthly implementation report and invoice. This payment is subject to the 65% limit on the amount of savings that can come from lighting measures, and subject to HL&P's on-site inspection results.

Measured Savings Option

The Measured Savings Option provides a mechanism of measurement and verification (M&V) where actual measurements and analysis are relied upon to calculate energy savings. This option has specific measurement and verification procedures, which are based on the International Performance Measurement and Verification Protocol (IPMVP). This Protocol specifies how and what M&V procedures are to be used in calculating energy savings. Project Sponsor will receive an initial payment that represents 40% of the total estimated incentive payment within 45 days after submitting an monthly implementation report and invoice, subject to HL&P's post-installation inspection results.

For measured savings projects, HL&P will use the following formula to calculate the amount of the initial (implementation) payment:

$$\text{Implementation Payment} = [((\text{estimated kW}) * (\$/kW \text{ incentive})) + ((\text{estimated kWh}) * (\$/kWh \text{ incentive}))] * 40\%$$

The second payment (the “Performance Payment”) will be based on the energy and demand savings that the Project Sponsor measures and documents in its M&V Report at the conclusion of the performance period. The performance period starts at the conclusion of the installation period and extends for up to one year to allow sufficient time for measurement of savings. Performance Payment may be up to 60% of the total estimated incentive included in the SOP Agreement, and will be calculated as follows:

$$\text{Performance Payment} = [((\text{measured kW saved}) * (\$/kW \text{ incentive})) + ((\text{measured kWh saved}) * (\$/kWh \text{ incentive}))] - \text{Implementation Payment}$$

Under no circumstances will HL&P make a total incentive payment (i.e., the sum of the implementation payment and the performance payment) that is more than 100% of the total estimated incentive payment specified in the SOP Agreement. If the final M&V Report indicates that the measured savings are less than the estimated savings, then the total incentive payment will be less than the payment estimated in the Agreement. If the above formula results in a negative amount, the Project Sponsor must refund that amount to HL&P within 45 days of the submittal of the M&V Report.

If the Project Sponsor specified the Measured Savings Option in the project application, it must either implement projects that conform to the Simplified M&V Guidelines for C&I Lighting Retrofits, as described below, or perform detailed measurement and verification (M&V) procedures that are specified in the International Performance Measurement Verification Protocol (IPMVP). The IPMVP Protocol contains four methodologies that the Project Sponsor can use to perform the necessary M&V. If the Project Sponsor intends to implement only those retrofits that conform to the Simplified M&V Guidelines for C&I Lighting Retrofits, then the Project Sponsor is not required to submit a detailed M&V plan as part of the supplemental Project Application information.

C&I Retrofit Wattage Table

For lighting measures, a C&I Retrofit Wattage Table has been developed, which contains wattages for hundreds of common fixture types, both retrofit and existing. The use of this table will greatly simplify the estimation of kW savings for lighting retrofits. This table may be downloaded from the reliantressop.com web site.

Detailed M&V Plan Requirements

If a Project Sponsor elects to provide a detailed M&V plan, it must conform with the International Performance Measurement and Verification Protocol (IPMVP). A copy of IPMVP may be downloaded from the World Wide Web at <http://www.ipmvp.org>. Copies can also be obtained from the following source:

Efficiency Renewable Energy Clearing House (EREC)

Contact by telephone at 1-800-DOE-EREC, or fax name, address & telephone number to EREC at (703) 893-0400, and ask for the “International Performance Measurement and Verification Protocol,” and include the code IPMVP. Project Sponsors may also transmit a request via E-mail at doe.erec@nclinc.com.

All four measurement options presented in IPMVP (Options A, B, C, &D) are applicable to residential and small commercial projects, given certain considerations. The choice of the M&V method is influenced by building and equipment type, along with the type of retrofit.

Simplified M&V For C&I Lighting Retrofits

I. Introduction

Under the simplified M&V approach, savings values are based on engineering calculations using typical equipment characteristics and operating schedules developed for particular applications. Simplified methods can reduce the need for certain types of field monitoring by using stipulated values for data such as operating hours, equipment efficiencies, etc. Project measures must meet certain criteria in order to calculate their resulting savings using a simplified M&V approach; detailed criteria may be found in the M&V guidelines specific to each equipment type. Simplified M&V guidelines have been developed for the types of retrofits summarized in Table 1.1.

Table 1.1. Simplified M&V Guidelines

Measure Type	Guideline Section
Lighting efficiency upgrades*	II
Lighting controls*	III

* For Reliant Energy - HL&P's Residential and Small Commercial Programs, the simplified M&V approach can only be used for the following building types: office, retail, education (K-12; no summer session), 24-hour supermarket, and in-patient health care. Facilities with a maximum demand which exceeds 100 kW are not considered Small Commercial customers, and are not eligible for incentives under this program.

For lighting measures, stipulated savings values may be used for many building types. For other measures, some short-term testing or simple long-term metering will be needed to calculate demand and energy savings. For example, chiller energy and demand savings can be determined using the simple approach by comparing rated efficiencies of high-efficiency equipment to standard equipment, and using kW spot-metering and simple long-term kWh metering.

II. Simplified M&V Guidelines for Lighting Efficiency Measures

Overview

This simplified measurement and verification (M&V) procedure is appropriate for projects that involve the replacement of existing fixtures, lamps, and/or ballasts with a similar number of new energy efficient fixtures, lamps, and/or ballasts. This procedure can also be used for projects involving delamping¹ with or without the use of reflectors. This stipulated hours method requires the use of the appropriate values listed in Table 2.1. If these tables do not accurately characterize the building type, then the project sponsor must submit a detailed M&V Plan.

Table 2.1 Stipulated Annual Operating Hours and Interactive Savings

Building Type	Stipulated Annual Operating Hours	Coincidence Factor During Hour of Maximum Demand Savings	Interactive HVAC Demand Savings	Interactive HVAC Energy Savings

¹ Delamping energy savings will only be eligible for incentives if done in conjunction with T8 lamp and electronic ballast retrofits.

Building Type	Stipulated Annual Operating Hours	Coincidence Factor During Hour of Maximum Demand Savings	Interactive HVAC Demand Savings	Interactive HVAC Energy Savings
Office	3,760	80%	10%	5%
Retail	4,250	95%	10%	5%
Education (K-12; no summer session)	2,150	85%	10%	5%
24-Hour Supermarket	6,900	95%	10%	5%
In-Patient Health Care	3,750	60%	10%	5%

Pre-Installation M&V Activities

Prior to installing lighting retrofit, the Project Sponsor conducts a pre-installation equipment survey. This survey should provide the following information about all the fixtures involved in the lighting retrofit: room location, fixture, lamp, and ballast types; lighting controls; area designations; counts of operating and non-operating fixtures; and type of control device. If Interactive effects are claimed, the survey must also indicated if the space is air-conditioned with electricity consuming equipment, and if the space is electrically heated.

Fixture wattages in both the pre and post case should be based on the *C&I Retrofit Wattage Table*. For example, the baseline for a standard 4-foot fluorescent fixture is a combination of 34-watt Energy Saver lamps with an energy efficient ballast.

Post-Installation M&V Activities

After the lighting retrofit has been completed, the Project Sponsor conducts a post-installation equipment survey. The proposed equipment provided in the pre-installation equipment survey information should be updated to reflect the equipment installed or modified.

Calculation of Demand and Energy Savings

The peak demand savings and energy savings are calculated according to Equations (a) through (f) below. Demand savings are only allowed for lighting fixtures that will be in operation on weekdays between the hours of 1 p.m. and 7 p.m. during the months of May through September. Interactive HVAC demand and energy savings may be calculated *only* for lighting retrofits taking place in electrically air-conditioned spaces. Lighting retrofits in unconditioned spaces, such as parking garages, are not eligible for interactive HVAC savings payments. Total demand savings are calculated using a coincidence factor to account for the average number of lights on during the hour of maximum demand reduction.

PEAK DEMAND SAVINGS

Equation (a)

Lighting Demand Savings [kW] = Pre Lighting Demand [kW] – Post Lighting Demand [kW]

Equation (b)

Interactive HVAC Demand Savings [kW] = Lighting Demand Savings [kW]*Stipulated Interactive HVAC Demand Savings [%]

Equation (c)

Total Demand Savings [kW] = (Lighting Demand Savings [kW] + Interactive HVAC Demand Savings [kW]) * Coincidence Factor

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Equation (d)

Lighting Energy Savings [kWh] = Lighting Demand Savings [kW]*Stipulated Annual Hours of Operation [hrs]

Equation (e)

Interactive HVAC Energy Savings [kWh] = Lighting Energy Savings [kWh]*Stipulated Interactive HVAC Energy Savings [%]

Equation (f)

Total Energy Savings [kWh] = Lighting Energy Savings [kWh] + Interactive HVAC Energy Savings [kWh]

Example¹

A lighting efficiency project is proposed for a typical small office building in Longview, Texas. The Sponsor submits the lighting survey forms as part of the Final Application detailing the existing and proposed equipment. The table below summarizes the existing and proposed connected lighting Load for each usage group in the project.

Area Description	Survey Lines	Connected Lighting Load (kW)			Stipulated Operating Hours	Annual kWh Savings
		Existing	Proposed	Saved		
Hallways and Stairs	5	0.9	0.5	0.4	3,760	1,504
Common Offices	9	8.3	1.8	6.5	3,760	24,440
Conference Rooms	5	3.9	2.4	1.5	3,760	5,640
Misc Facilities	6	1.5	1.2	0.3	3,760	1,128
Private Offices	6	8.1	5.6	2.5	3,760	9,400
Restrooms	5	1.0	0.7	0.3	3,760	1,128
Total	36	23.7	12.2	11.5		43,240

Based on the collected data, the demand and energy savings are calculated:

- (a) Lighting Demand Savings = 23.7 [kW] – 12.2 [kW]
= 11.5 kW.
- (b) Interactive HVAC Demand Savings = 11.5 [kW]*0.10
= 1.15 kW.
- (c) Total Demand Savings = (11.5 [kW] + 1.15 [kW])*0.80
= **10.12 kW.**
- (d) Lighting Energy Savings = 11.5 [kW] * 3,760 [hrs]
= 43,240 kWh.
- (e) Interactive HVAC Energy Savings = 43,240 [kWh]*0.05
= 2,162 kWh.
- (f) Total Energy Savings = 43,240 [kWh] + 2,162 [kWh]
= **45,402 kWh.**

¹ Projects that consist of only lighting measures receive 65% of the total incentive per the Lighting Adjustment Factors in Appendix E.

III. Simplified M&V Guidelines for Lighting Efficiency with Controls Measures

Overview

This Simplified Measurement and Verification (M&V) procedure is appropriate for lighting efficiency measures in combination with lighting controls retrofit measures. Lighting efficiency measures may include the replacement of existing fixtures, lamps, and/or ballasts with new energy efficient fixtures, lamps, and/or ballasts, as well as delamping² with or without the use of reflectors. Controls measures may be occupancy sensors or daylighting controls.

This method requires the use of the appropriate stipulated hours from Table 3.1 and a Power Adjustment Factor (PAF) from Table 3.2. If values from these tables do not accurately characterize the building type and operation, then the Project Sponsor must submit a detailed M&V Plan.

Table 3.1. Stipulated Annual Operating Hours and Interactive Savings

Building Type	Stipulated Annual Operating Hours	Coincidence Factor During Hour of Maximum Demand Savings	Interactive HVAC Demand Savings	Interactive HVAC Energy Savings
Office	3,760	80%	10%	5%
Retail	4,250	95%	10%	5%
Education (K-12; no summer session)	2,150	85%	10%	5%
24-Hour Supermarket	6,900	95%	10%	5%
In-Patient Health Care	3,750	60%	10%	5%

² Delamping energy savings will only be eligible for incentives if done in conjunction with T8 lamp and electronic ballast retrofits.

Table 3.2. Power Adjustment Factors (PAFs)*

Control Type	Power Adjustment Factor
Daylight controls (DC) – continuous dimming	0.70
DC – multiple-step dimming	0.80
DC – ON/OFF	0.90
Occupancy sensor (OS)	0.70
OS w/ DC – continuous dimming	0.60
OS w/ DC – multiple-step dimming	0.65
OS w/ DC – ON/OFF	0.65

*Power Adjustment Factors are adapted from ASHRAE Standard 90.1-1989, Table 6-3.

Pre-Installation M&V Activities

Prior to installing lighting retrofit, the Project Sponsor conducts a pre-installation equipment survey. This survey should provide the following information about all the fixtures involved in the lighting retrofit: room location, fixture, lamp, and ballast types; lighting controls; area designations; counts of operating and non-operating fixtures; and type of control device.

If Interactive effects are claimed, the survey must also indicated if the space is air-conditioned with electricity consuming equipment, and if the space is electrically heated. Fixture wattages in both the pre and post case should be based on the *C&I Retrofit Wattage Table*. For example, the baseline for a standard 4-foot fluorescent fixture is a combination of 34 watt Energy Saver lamps with an energy-efficient ballast.

Post-Installation M&V Activities

After the lighting retrofit has been completed, the Project Sponsor conducts a post-installation equipment survey. The proposed equipment provided in the pre-installation equipment survey information should be updated to reflect the equipment installed or modified.

Calculation of Demand and Energy Savings

The peak demand savings and energy savings are calculated according to Equations (a) through (f) below. Demand savings are only allowed for lighting fixtures that will be in

operation on weekdays between the hours of 1 p.m. and 7 p.m. during the months of May through September. Interactive HVAC demand and energy savings may be calculated *only* for lighting retrofits taking place in electrically air-conditioned spaces. Lighting retrofits in non air-conditioned spaces, such as parking garages, are not eligible for interactive HVAC savings payments. Total demand savings are calculated using a Coincidence factor to account for the average number of lights on during the hour of maximum demand reduction. No demand savings are credited to the controls.

PEAK DEMAND SAVINGS

Equation (a)

Lighting Demand Savings [kW] = Pre Lighting Demand [kW] – Post Lighting Demand [kW]

Equation (b)

Interactive HVAC Demand Savings [kW] = Lighting Demand Savings [kW]*Stipulated Interactive HVAC Demand Savings [%]

Equation (c)

Total Demand Savings [kW] = (Lighting Demand Savings [kW] + Interactive HVAC Demand Savings [kW]) * Coincidence Factor

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Equation (d)

Lighting Energy Savings [kWh] = {Pre Lighting Demand [kW] – (Post Lighting Demand [kW] *Power Adjustment Factor [%])}*Stipulated Annual Hours of Operation [hrs]

Equation (e)

Interactive HVAC Energy Savings [kWh] = Lighting Energy Savings [kWh]*Stipulated Interactive HVAC Energy Savings [%]

Equation (f)

Total Energy Savings [kWh] = Lighting Energy Savings [kWh] + Interactive HVAC Energy Savings [kWh]

Example²

A lighting efficiency and controls project is proposed for a typical small office building in Longview, TX. Controls are to be installed in some common offices, private offices and restrooms. The Project Sponsor submits the lighting survey detailing the existing and proposed equipment inventory. The following table summarizes the existing and proposed connected lighting load and operating hours for each usage group in the project.

Area Description	Connected Load (kW)		New control type	PAF Table 2.2	Pre-retrofit hours Table 2.1
	Existing	Proposed			
Common Offices w/ controls	9.0	4.3	Daylight control—multi-step dimming	0.8	3,760
Private Offices	5.2	2.1			3,760
Private Offices w/controls	4.3	2.0	Occupancy sensor	0.7	3,760
Conference Rooms	3.9	1.5			3,760
Restrooms	0.3	0.1			3,760

Pre-retrofit operating hours are determined using the Stipulated Hours Method. The stipulated annual operating hours for office buildings is 3,760 hours/year. Usage groups that are being retrofitted with controls are divided into control and non-control usage groups. The post-retrofit hours for the control usage groups are multiplied by the PAF corresponding to the type of control being utilized. The post-retrofit hours for the non-control usage groups remain unchanged from the pre-retrofit hours. Using equations (a) through (f), the energy savings for the *Common Offices With Controls* will be

$$\begin{aligned} \text{(a) Lighting Demand Savings [kW]} &= 9.0 \text{ [kW]} - 4.3 \text{ [kW]} \\ &= \mathbf{4.7 \text{ [kW]}} \end{aligned}$$

$$\begin{aligned} \text{(b) Interactive HVAC Demand Savings [kW]} &= 4.7 \text{ [kW]} * 0.10 \\ &= \mathbf{0.5 \text{ [kW]}} \end{aligned}$$

$$\begin{aligned} \text{(c) Total Demand Savings [kW]} &= (4.7 \text{ [kW]} + 0.5 \text{ [kW]}) * 0.80 \\ &= \mathbf{4.2 \text{ [kW]}} \end{aligned}$$

$$\begin{aligned} \text{(d) Lighting Energy Savings [kWh]} &= \{9.0 \text{ [kW]} - (4.3 \text{ [kW]} * 0.8)\} * 3760 \text{ [hrs]} \\ &= \mathbf{20,906 \text{ [kWh]}} \end{aligned}$$

$$\begin{aligned} \text{(e) Interactive HVAC Energy Savings [kWh]} &= 20,906 \text{ [kWh]} * 0.05 \\ &= \mathbf{1,045 \text{ [kWh]}} \end{aligned}$$

$$\begin{aligned} \text{(f) Total Energy Savings [kWh]} &= 20,906 \text{ [kWh]} + 1,045 \text{ [kWh]} \\ &= \mathbf{21,951 \text{ [kWh]}} \end{aligned}$$

The energy savings is then calculated for each usage group.

² Projects that consist of only lighting measures receive 65% of the total incentive per the Lighting Adjustment Factors in Appendix E.

Area Description	Results					
	(a)	(b)	(c)	(d)	(e)	(f)
Common Offices w/ Controls	4.7	0.5	4.2	20,906	1,045	21,951
Private Offices	3.1	0.3	2.7	11,656	583	12,239
Private Offices w/ Controls	2.3	0.2	2.0	10,904	545	11,449
Conference Rooms	2.4	0.2	2.1	9,024	451	9,475
Restrooms	0.3	0	0.2	1,128	56	1,184
Total			11.2			56,298