**Work Paper WPSDGENRLG0120**

**Revision 3**

**San Diego Gas & Electric**

**Energy Efficiency Engineering**

**Replacement of existing 4-foot 32 Watt T8, to 4-foot 28-Watt or 25-Watt T8 Lamps**

**At-A-Glance Measure List**

|  |  |
| --- | --- |
| **Applicable Measure Codes:** | **L-T11, L-T12** |
| **Measure Description:** | The installation of 4 ft. 25 or 28 Watts, T8 Lamps that replaced a 32 Watts T8 Lamps |
| **Energy Impact Common Units:** | Lamps |
| **Base Case Description:** | 32 Watts T8 Lamps |
| **Base Case Energy Consumption:** | 32 Watts |
| **Measure Energy Consumption:** | L-T11: 25 Watts  L-T12: 28 Watts |
| **Energy Savings (Base Case – Measure)** | L-T11: 7 Watts  L-T12: 4 Watts  Refer to calculation sheet4, for all savings by climate zone and building type associated with this measure. |
| **Costs Common Units:** | $/Lamps |
| **Base Case Equipment Cost ($/unit):** | $Base case lamp cost is $1.50 per lamp |
| **Measure Equipment Cost ($/unit):** | Replacement Cost for **28 Watts T8** or **25 Watts T8** Lamps is $2.00 |
| **Measure Incremental Cost ($/unit):** | $0.50 per lamp |
| **Effective Useful Life (years):** | 15 years or less (refer to calculation sheet3 for details)  **Source: DEER 2008** |
| **Program Type:** | Downstream prescriptive |
| **Net-to-Gross Ratios:** | .7  **Source: DEER 2011** |
| **Important Comments:** | This measure is contractor driven and therefore considered Direct Install |

# Work Paper Approvals

|  |  |
| --- | --- |
| **Harmstead Charles** | Date |
|  |  |

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| --- | --- |
| **Insert name and Title** | Date |

# Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision #** | **MM/DD/YY** | **Author/Affiliation** | **Summary of Changes** |
| 0 | 07/13/2009 | Lucie Sidibe /SDGE | Original work paper |
| 1 | March 31, 2010 | Lucie Sidibe /SDGE | Update saving calculation to include new deer 2008 values |
| 2 | 8/12/2011 | Charles Harmstead/SDGE | Updated Equipment cost, revised 25 watt lamp savings, update measure savings to meet DEER 3.02 Lighting Work Book hours and interactive effects. Added Dual Baseline qualification statement |
| 3 | 6/4/12 | Charles Harmstead /SDGE | Updated NTGR for 2011DEER(Modified naming convention to include “WPSDGENRLG” instead of only “WPSDGENRL”, updated August 17, 2012). |

# Section 1. General Measure & Baseline Data

## Measure & Delivery Description

This work paper details the replacement of first and Second generation 32 W T8 Lamps (i.e.: 700 and 800 series) with reduced wattage 28 Watt or 25 watts T8 Lamp in existing lighting systems. The replacement lamp and ballast must be tested in accordance with the appropriate IESNA and ANSI reference standards, and must meet OSHA/NRTL and UL safety guidelines and be CEE approved. These lamps should be applied in accordance with national best practices in lighting design such as (1)IESNA Recommended Practices and (2)Lighting power densities prescribed by local and state building codes. Additionally, the lamps must meet the Color Rendering Index (CRI) and Minimum rated lamp life standard listed below.

**Table1: T8 Lamp Specifications**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Lamp Type & size** | **Ballast Type** | **Wattage/lamp** | **Rated Lamp Life** | **Minimum Initial Lamp Lumens** | **CRI** |
| T8 lamp-4ft | Instant Start or  Programmed Rapid-Start Ballast | 25 | ≥24,000 Hrs.  @ three hours per start | ≥3100 Lumens*5* | ≥80 |
| T8 lamp-4ft | Instant Start or  Programmed Rapid-Start Ballast | 28 | ≥24,000 Hrs.@ three hours per start | ≥3100 Lumens | ≥80 |

*5For lamps with color temperatures >4500 K, 2950 minimum initial lamp lumens are specified pending further consideration by CEE.*

**The delivery mechanism:**

The delivery method The Express Efficiency Prescriptive Rebates Program

## DEER Differences Analysis

These specific measures are not included in the Database for Energy Efficient Resources (DEER) Version 2008.2.05, although the database contains similar interior lighting retrofit measures.

For a discussion of the appropriate effective useful life, see Section 1.4, and for a discussion of the appropriate net-to-gross ratio, see Section 1.5

## Code Analysis

**California’s Title 24 Building Energy Efficiency Standards**

Title 24 2008 does not apply in this case because the measure only involves replacing lamps and it is not replacing the housing of the existing fixture nor is it increasing the connected lighting load. Baseline lamps already T8 include electronic ballasts, which comply with Federal Regulations and Title 24. Baseline is code compliant.

* 1. Measure Effective Useful Life

The Effective Useful Life is an estimate of the median number of years that the measures installed under the program are still in place and operable. For this measure the **EUL is rated as the Life of Ballast (70,000 hours) / Annual usage for building type**. A summary of all EUL is available in the embedded calculation sheet4.

This is also referenced in the DEER EUL Summary2. Baseline lamp is code compliant, so no dual baseline consideration of RUL/ EUL is required

## 1.5 Net-to-Gross Ratios for Different Program Strategies

Net-to-Gross (NTG) Ratios are used to estimate free-ridership occurring in energy efficiency programs. Free riders are program participants who would have undertaken an activity whether or not there was an energy efficiency program promoting that activity. A NTG Ratio is a factor that represents the net program load impact divided by the gross program load impact. This factor is applied to gross program savings to determine the program's net impact.

The recommended Net-to-Gross Ratio (NTGR) for these measures are assumed to be **0.70**

This NTG value was obtain from the DEER 2011 NTG ID NonRes-sAll-mT5T8-dn. The relevant NTGR for this measure is shown in the table below.

**Table2: NTG Summary**

|  |  |  |
| --- | --- | --- |
| **Delivery Method** | **Program Name** | **NTG** |
| Downstream Prescriptive Rebate | Express Efficiency Program | 0.70 |

# Section 2. Energy Savings & Demand Reduction Calculations

**2.1 Energy Savings Calculations**

The Assumed existing systems are taken to be: reduced wattage T8 lamps 4 foot 32Watt system The replacement system is taken to be a 4foot 28 or 25 watt per lamp T8 system. This results is a lighting system watts savings (∆Watts) of:

 [**Equation 1**]

When the replacement system is taken to be a 4foot 28 watt per lamp

∆Watts: 32-28= 4Watts/lamp

When the replacement system is taken to be a 4foot 25 watt per lamp

∆Watts: 32-25= 7 Watts/lamp.

**Hours of Operation and Interactive Effects**

Gross annual energy savings are dependant on the hours of operation as well as energy interactive effects specific to the market sector in which the measure is installed. Equation 2 below was utilized to calculate the annual energy saving.

For the purpose of this work paper, Annual hours of operation was obtain from the Energy Efficient Resources (DEER) 3.02 Lighting Workbook A summary table with applicable values per market sector is provided below.

**Table3: Hours of Operation Summary**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DEER 2008 |  | Equivalent Full Load Hours | | |
| Lighting Hours of Use |  | Indoor | Indoor | Outdoor |
| Building Type | Bldg Code | CFL | Other | All |
| See DEER lighting Workbook |  |  |  |  |

 [**Equation 2**]

**\*Interactive effect value was derived from DEER 3.02 refer to attached calculation sheet for details.**

**2.2 Demand Reduction Estimation Methodologies**

The demand reduction estimates are based upon the DEER methodology for Express Efficiency type programs. The methodology for demand reduction is shown in Equation3 below:

**Formula:**

Demand Reduction =  [**Equation 3**]

(ΔWatts / unit) is the same as described above in the Energy Savings calculation Methodologies section. Demand Interactive Effects and Peak Coincidence Factor are derived from the DEER 3.02 Lighting Workbook. For a summary of savings values, refer to embedded excel calculation sheet.

**2.3 Gas Energy Saving Estimation**

Only losses in Gas savings are associated with these measures

DEER 3.02 Lighting Work book calculates therm loss as delta watts \* therm factor

# Section 3. Load Shapes

DEER 3.02 Lighting Workbook incorporates load shape information

# Section 4. Base Case & Measure Costs

## 4.1 Base Case Cost

In this case the base case is assumed to be an existing 32 Watts T8 lamp. The cost for the base case was taken from Web pricing. Average price was $1.50 per lamp

Baseline lamp is code compliant, so dual baseline is not required.

Table4: Base case Cost

|  |  |  |  |
| --- | --- | --- | --- |
| **Manufacturer** | **Model #** | **Lamp Type** | **Cost** |

See attached Web search pricing for lamps

## 4.2 Full Measure Cost

Lamp replacement programs are contractor driven. Ninety –seven percent of all SDGE lighting rebates are filed by contractors. The cost a contractor pays for lamps determines his profit, so lamps selected are evaluated at minimum cost. Program criteria require all reduced wattage lamps installed to be listed on CEE Reduced Wattage Table. A web search was performed to document minimum cost for CEE Reduced Wattage Table compliant lamps. (What a contractor would select to minimize his costs). Minimum lamp costs were around $2.00/ lamp.

Table5: Measure Cost

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Manufacturer** | **Model #** | **Lamp Type** |  | **Cost** |

See attached Web search pricing for lamps

## 4.3 Incremental Measure Cost

**Retrofit DEEMED**

Incremental cost is 50 cents per lamp

**Replace on Burnout/NEW**

The IMC (∆cost/unit) is defined as the difference in costs between the base case and the measure equipment. Installation labor costs are assumed to be the same.

# References

*1. DEER 2011 NTGR*



2.2008 Database for Energy-Efficient Resources, December 2008.



3. DEER 3.02 Calculation Sheet



5. Web search Lamp Pricing

