Short Form Work Paper WPSDGENRAG0003

**Revision 0**

**San Diego Gas & Electric**

**Energy Efficiency Engineering**

**Agriculture Greenhouse Thermal Curtains**

**Implementation code: 402402**

**January 1, 2019**

# Greenhouse Thermal Curtains Short Form WP

## Introduction

This short form workpaper documents the Ex-ante data by referencing the DEER/READI v2.5.1 database Measure ID “Grnhs-Shell-ThermCurt”, installation of a thermal heat curtains for greenhouses, and technology cost table IDs, Table 1. The cost values for installation of thermal heat curtains, for greenhouses, are adapted for present value from ITRON cost study ““2010-2012 WO017 Ex Ante Measure Cost Study” dated February 28, 2014. Table 1 below documents the Measure ID and Technology Cost IDs adopted from DEER/READI v2.5.1 and WO17 cost study. Given that the Measure Application Type is “Add-on-Equipment” (AOE) the Standard Cost ID (Std Cost ID) is zero, because the pre-existing or standard case is no heat curtain.

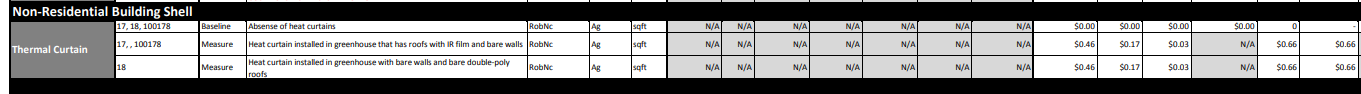
Table 1: DEER Measure IDs and Adopted WO17 Technology Table Cost IDs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SDGE Imp. ID | DEER Msr ID | Msr Cost ID / Value | Std Cost ID / Value | IMC  (Units = sq.ft.) |
| 465336 | Grnhs-Shell-ThermCurt | SDG-Agr-GHC-mHtCrtn-FULL / $0.79 | BaseCostZero / $0.00 | $0.79 |

Table 2: Retirement of SDG&E Implementation offering

|  |  |  |  |
| --- | --- | --- | --- |
| SDGE Implementation ID | Start Date | End Date | Description |
| 402402 | 1/1/2013 | 12/31/2018 | Installation of Greenhouse Heat Curtains |

Table 3: ITRON WO17 cost for “Heat curtain installed in greenhouse that has roofs with IR film and bare wall”, Appendix F - Ex Ante Measure Cost Estimates Based on READI v.1.0.4 Definitions for In-scope Measures, page 347.



Measure Description: Heat curtain installed in greenhouse that has roofs with IR film and bare walls. Unit = per square foot (sq.ft).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Year | Equipment Cost per unit | Labor Cost per unit | Misc. Cost per Unit | Full Cost per unit | Incremental Cost per unit (IMC) | Inflation Rate (i=3%) | Inflation Adder per IMC |
|
| 2013 | $ 0.46 | $ 0.17 | $ 0.03 | $ 0.66 | $ 0.66 | 3% | $ 0.02 |
| 2014 | $ 0.47 | $ 0.18 | $ 0.03 | $ 0.68 | $ 0.68 | 3% | $ 0.02 |
| 2015 | $ 0.49 | $ 0.18 | $ 0.03 | $ 0.70 | $ 0.70 | 3% | $ 0.02 |
| 2016 | $ 0.50 | $ 0.19 | $ 0.03 | $ 0.72 | $ 0.72 | 3% | $ 0.02 |
| 2017 | $ 0.52 | $ 0.19 | $ 0.03 | $ 0.74 | $ 0.74 | 3% | $ 0.02 |
| 2018 | $ 0.53 | $ 0.20 | $ 0.03 | $ 0.77 | $ 0.77 | 3% | $ 0.02 |
| 2019 | $ 0.55 | $ 0.20 | $ 0.04 | $ 0.79 | $ 0.79 |  |  |

* SDG&E starting 1/1/2019 shall use a measure cost value = $0.79/unit.

Exception and Differences from DEER READi v2.5.1 Measure

* For the given measure described herein above, DEER 2011 defines the application type as “ROB/NC”, and SDG&E implementation offering is based on measure application type of “Add-on Equipment” (AOE) as to align with the DEER 2020 NTG Ratio table.



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**Document Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 01/01/2019 | Eduardo Reynoso / SDG&E | 1. New short form workpaper to migrate SDG&E legacy measure offering 402402 from SDG&E’s DEER Measures workpaper “WPSDGENRMI0004-Rev2”, for Greenhouse Heat Curtain DEER2011 measure “Grnhs-Shell-ThermCurt”. 2. Updated Measure Application Type (MAT) per CPUC DEER Resolution E-4952/E-4818. Starting 1/1/2019 the MAT shall be “AOE”- Add-on-Equipment. 3. Measure Cost update starting the 1/1/2019, to reflect present value equipment and labor cost for installation of thermal heat curtains on a greenhouse based on ITRON’s “2010-2012 WO017 Ex Ante Measure Cost Study”. 4. Cited additional technical information from PGE’s workpaper PGECOAGR1010, Revision 0. |

Eligibility Requirements for Energy Efficiency Rebate Program (EEBR)

* + - Pre-inspection required, customer to submit an online application at sdge.com/bizrebates to schedule a pre-inspection
    - Only installations of interior curtains for heat retention in existing gas-heated greenhouses qualify
    - The rebate applies to new and retrofit curtain system installations in existing greenhouses for specific agricultural end-use.
    - The agricultural uses include horticultural specialties such as ornamental floriculture, nursery products and food crops grown under cover (NAICS 1114) and landscape and horticultural services (NAICS 541 & 561) which store agricultural products under cover.
    - Product must be designed by the manufacturer to be a heat curtain, and the installation must have the ability to automatically or manually move the curtain into place.
    - Curtain must be located such that the gas heat source provides hot air to conditioned space bounded by the curtain.
    - Curtain material must have an Energy Savings rating of greater than 40% and must have a warranty/product life of 5 years.
    - Rebate amount is for square footage of curtain material.
    - Must include the manufacturer’s specification sheet documenting type of curtain.
    - Rebate amount cannot exceed square feet of qualifying curtain material purchased, paid for and properly installed at SDG&E account listed on the rebate form.
    - Rebate amount also cannot exceed the square feet of floor space covered by the installation of the curtain material.
    - Rebate amount also cannot exceed the square feet of floor space covered by the installation of the curtain material.
    - Must provide greenhouse square footage on the Energy Efficiency Business Rebates Application.
    1. Eligibility for Streamlined Ag Efficiency rebates and incentives is limited to customers of SDG&E on an agricultural rate schedule in the following NAICS industry groups:
    - 1111 Oilseed and Grain Farming
    - 1112 Vegetable and Melon Farming
    - 1113 Fruit and Tree Nut Farming
    - 1114 Greenhouse, Nursery, and Floriculture Production 1119 Other Crop Farming
    - 1121 Cattle Ranching and Farming
    - 1112 Hog and Pig Farming
    - 1123 Poultry and Egg Production
    - 1124 Sheep and Goat Farming
    - 1125 Animal Aquaculture
    - 1129 Other Animal Production
    - 1151 Support Activities for Crop Production
    - 1152 Support Activities for Animal Production
    - 1153 Support Activities for Forestry
    1. Steamline Ag Efficiency is a third-party program administered by Cascade Energy Inc.

Streamlined Ag Efficiency provides technical assistance and financial rebates or incentives for qualifying equipment but does not install energy systems or equipment. Installation work is done by independent contractors with no relation to Cascade Energy, Inc.; these contractors are solely responsible for the quality and performance of their installations. In no event will Cascade Energy Inc. or SDG&E be liable for incidental or consequential damages of any kind in connection with energy savings estimates, installation of recommended measures, or with the operation of customer facilities.

* + 1. Exclusions: Overhang and overlap of curtain material does not qualify for rebate.

**Measure Summary**

**Table 1: Measure Summary Table**

| **Section** | **Value** |
| --- | --- |
| **Summary & Purpose** | This short form workpaper documents ex-ante adoption of DEER READi tool v2.5.1 load impacts, cost-effectiveness values, and offering implementation details. The heat curtain measure cost values (equipment and labor) have been adapted from the ITRON WO17 cost study, for present value. A new respective Measure Cost IDs is proposed, as stated herein in the re-vision history. |
| **1.1 Measure & Baseline Data** | Per DEER/READI v2.5.1 with MeasureIDs as noted herein.   |  |  |  | | --- | --- | --- | | SDGE Imp. ID | DEER Msr ID | Description | | 465336 | Grnhs-Shell-ThermCurt | Heat curtain installed in greenhouse with bare walls and bare double-poly roofs | |
| **1.2 Technical Description** |  |
| Measures | Per DEER/READI Measures IDs as noted herein above per Revision History |
| Code for All Measures | Greenhouses and the heat curtains measures are not governed by either state or federal codes and standards.  Title 20: These measures do not fall under Title 20 of the California Energy Regulations.  Title 24: These measures do not fall under Title 24 of the California Energy Regulations.  Federal Standards: These measures do not fall under Federal DOE or EPA Energy Regulations.  CPUC Ex-ante for custom calculated and deemed dispositions for PGE have suggested that installation of thermal heat curtains for “Replace-on-Burnout” (ROB) are more likely than not standard practice.  To address the issue of standard practice SDG&E PA is restricting the offering by:   * MAT is defined as “Add-on Equipment” (AOE) versus ROB/NC as defined per DEER measure. * Requires a pre-inspection of customer site * Refer to Requirement as stated herein above |
| **1.3 Installation Type and Delivery Mechanisms** |  |
| Installation Type | * Add-on Equipment (AOE) |
| Delivery Mechanisms | * Downstream Rebate – Deemed |
| **1.4.1 DEER Data** |  |
| Net-to-Gross Ratio | The following NTG is based on the 2020 NTG Ratio support table     |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | NTG ID | Start date | Description | Value | MAT | Delivery type | | NonRes-sGHS-mHtCrtn-dn | 1/1/2019 | Greenhouse heat curtain | 0.63 | AOE | Downstream | |
| Effective and Remaining Useful Life | |  |  |  | | --- | --- | --- | | EUL ID | Description | EUL\_Yrs | | Agr-GHC | Greenhouse Heat Curtain | 5 | | Notes: It is necessary to select RUL ID for the host equipment, given that Resolution E-4952/E-4818 state that MAT for Add-on-Equipment (AOE) should use the RUL of the host equipment. The current DEER READI v2.5.1 support tables for EUL/RUL does not support or list Greenhouse EUL/RUL. A best fit for using the same “Use Category” = BldgEnv is listed below for the given RUL table. | | |   Recommended best fit RUL of host equipment   |  |  |  |  | | --- | --- | --- | --- | | RUL ID | Description | RUL\_Yrs | Notes | | BldgEnv-CoolRoof | Cool Roof – Commercial | 5 | Best fit | | Note: the given RUL values listed below are for informational comparison only. | | | | | HVAC-2Spd | Two-Speed Fan | 5 | Comparison | | LtgFixture-Default | Default EUL/RUL for lighting fixtures | 5 | Comparison | |
| Installation Rate | GSIA ID = Def-GSIA = AnnInstRate= 1.00 |
| **Section 2. Calculation Methodology** | Measures will be processed using DEER EnergyImpactID by building type = “GHs”, customer building location and customer HVAC type. All will be processed and claimed using vintage =“Any”. |
| Energy Savings/Peak Demand Reduction – All Measures | All Energy Impacts per DEER EnergyImpact IDs noted above |
| **Section 3. Load Shapes** | ElecImpProfile: SDGE:35-OTI-OtherIndustrial-AG\_PUMP  Gas: Annual |
| **Section 4. Costs** |  |
| Base Cost | |  |  |  |  | | --- | --- | --- | --- | | SDG&E Impl. ID | Base Cost ID | Base Cost Value | Units | | 402402 | BaseCostZero | $0.00 | Sq.ft | |
| Measure Cost | |  |  |  |  |  | | --- | --- | --- | --- | --- | | SDG&E Impl. ID | Measure Cost ID | Msr Cost Value | IMC | Units | | 402402 | SDG-Agr-GHC-mHtCrtn-FULL | $0.79 | $0.79 | Sq.ft | |

Additional Information cited from PGE’s workpaper PGECOAGR101, Revision 0

Technical Description: Single-Layer Heat Curtains

Typically, greenhouse thermal curtains are designed to be placed horizontally above the growing zone within a greenhouse. Energy is saved in three ways: they trap an insulating air film; the volume of space requiring heating is reduced; and heat curtains with aluminized strips reflect rising heat back into the growing zone.

A vendor participating in the PG&E Greenhouse Baseline study explained that there are two basic types of thermal curtain installations: flat, and slope-flat-slope. The flat is under the gutter level and operates in a horizontal plane. The slope-flat-slope (or tent) installation is used with some greenhouses that have other equipment to avoid, or for growers who want to minimize the air trapped above the curtain (or maximize the area below). Their product is warranted for five years underneath any type of glazing, and they claim an actual replacement interval of every 7-12 years depending on use, installation quality, etc.

According to Bartok4, there are many different materials used as thermal curtains. Porous materials allow condensation to drain, but are not as effective as nonporous materials in reducing energy use. However, nonporous curtains could cause the track system to fail if they become too heavy from collected moisture. Aluminized curtains save about 10% more energy than non-aluminized curtains. The aluminized curtains are typically a 55% woven white polyester film and double for use as shading. Bartok also refers to research conducted in large greenhouses with parallel bays and compares the effectiveness of reflective curtains facing both directions. The results indicate that outward-facing reflective surface retained heat slightly better than an inward-facing system.

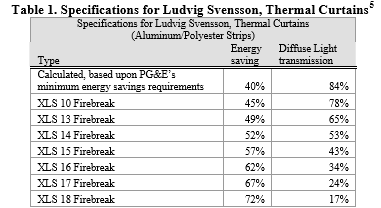


Table 1 presents the specifications for thermal curtains from a large manufacturer. This analysis will assume the heat curtain has an energy savings factor of 40%, based upon PG&E’s minimal requirement for qualifying products, with a calculated diffuse light transmission of 84%. The figure below illustrates the calculations for arriving at the diffuse light transmission of a 40% energy savings factor heat curtain.

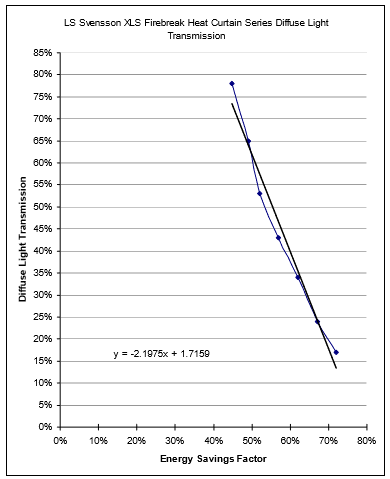


Figure 1. Graph of Ludvig Svensson XLS Firebreak Energy Curtains. Diffuse Light Transmission vs Energy Savings Factor.



Figure 2. Photograph of Ludvig Svensson XLS Firebreak Energy Curtain