**Work Paper SCE13WP007**

**Revision 0**

**Southern California Edison Company**

**Low Pressure Sprinkler Nozzles**

### Core Measure Summary Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| General Measure Information | | | | | | | | PT | | 1st Baseline Period | | | | 2nd Baseline Period | | | | TOU |
| Measure Name | Measure RunID | Solution Code | CZ | Building Type | Load Shape | EUL | Unit Definition | Program Type (NEW, ROB, RET) | Applicable Code | Gross Unit Annual Electricity Savings (kWh/unit) | User Entered kW Savings per unit (kW/unit) | Gas Savings (Therms) | 1st Baseline Useful Life | kWh Saving per unit (kWh/unit) | kW Savings per unit (kW/unit) | Gas Savings (Therms) | 2nd Baseline Useful Life | % TOU |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads |  | PM-57328 | 06 | Agricultural | Ag & Water Pumping | 5.0 | Unit | RET | No | 7.00 | 0.00300 | 0.00 | 5.00 | N/A | N/A | N/A | N/A | 0.00 |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads |  | PM-57328 | 08 | Agricultural | Ag & Water Pumping | 5.0 | Unit | RET | No | 7.00 | 0.00300 | 0.00 | 5.00 | N/A | N/A | N/A | N/A | 0.00 |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads |  | PM-57328 | 09 | Agricultural | Ag & Water Pumping | 5.0 | Unit | RET | No | 7.00 | 0.00300 | 0.00 | 5.00 | N/A | N/A | N/A | N/A | 0.00 |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads |  | PM-57328 | 10 | Agricultural | Ag & Water Pumping | 5.0 | Unit | RET | No | 7.00 | 0.00300 | 0.00 | 5.00 | N/A | N/A | N/A | N/A | 0.00 |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads |  | PM-57328 | 13 | Agricultural | Ag & Water Pumping | 5.0 | Unit | RET | No | 10.00 | 0.00400 | 0.00 | 5.00 | N/A | N/A | N/A | N/A | 0.00 |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads |  | PM-57328 | 14 | Agricultural | Ag & Water Pumping | 5.0 | Unit | RET | No | 10.00 | 0.00400 | 0.00 | 5.00 | N/A | N/A | N/A | N/A | 0.00 |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads |  | PM-57328 | 15 | Agricultural | Ag & Water Pumping | 5.0 | Unit | RET | No | 10.00 | 0.00400 | 0.00 | 5.00 | N/A | N/A | N/A | N/A | 0.00 |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads |  | PM-57328 | 16 | Agricultural | Ag & Water Pumping | 5.0 | Unit | RET | No | 7.00 | 0.00300 | 0.00 | 5.00 | N/A | N/A | N/A | N/A | 0.00 |

Note: **For the complete list of Measures, refer to the attached calculation spreadsheet**

### Costing and NTG Summary Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| General Measure Information | | | | PT | | NTG | | | IR | 1st Baseline Period | 2nd Baseline Period | IMC | DIM |
| Measure Name | Solution Code | CZ | Unit Definition | Program Type (NEW, ROB, RET) | Applicable Code | NTG Non-Res. | NTG Res. | NTG Multi Family | Installation Rate | Gross Measure Cost per unit | Gross Measure Cost per unit | Incremental Measure Cost per unit | Delivery & Incentive Method |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | PM-57328 | 6 | Unit | RET | No | 0.60 | 0.00 | 0.00 | 1.00 | $1.51 | $0.00 | $0.00 | Financial Support / Down-Stream Incentive - Deemed |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | PM-57328 | 8 | Unit | RET | No | 0.60 | 0.00 | 0.00 | 1.00 | $1.63 | $0.00 | $0.00 | Financial Support / Down-Stream Incentive - Deemed |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | PM-57328 | 9 | Unit | RET | No | 0.60 | 0.00 | 0.00 | 1.00 | $1.68 | $0.00 | $0.00 | Financial Support / Down-Stream Incentive - Deemed |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | PM-57328 | 10 | Unit | RET | No | 0.60 | 0.00 | 0.00 | 1.00 | $1.57 | $0.00 | $0.00 | Financial Support / Down-Stream Incentive - Deemed |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | PM-57328 | 13 | Unit | RET | No | 0.60 | 0.00 | 0.00 | 1.00 | $1.56 | $0.00 | $0.00 | Financial Support / Down-Stream Incentive - Deemed |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | PM-57328 | 14 | Unit | RET | No | 0.60 | 0.00 | 0.00 | 1.00 | $1.53 | $0.00 | $0.00 | Financial Support / Down-Stream Incentive - Deemed |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | PM-57328 | 15 | Unit | RET | No | 0.60 | 0.00 | 0.00 | 1.00 | $1.63 | $0.00 | $0.00 | Financial Support / Down-Stream Incentive - Deemed |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | PM-57328 | 16 | Unit | RET | No | 0.60 | 0.00 | 0.00 | 1.00 | $1.72 | $0.00 | $0.00 | Financial Support / Down-Stream Incentive - Deemed |

Note: **For the complete list of Measures, refer to the attached calculation spreadsheet**

# Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| Revision # | MM/DD/YY | Author/Affiliation | Summary of Changes |
| 0 | 1/13/2012 | Jason Wang/SCE | Original workpaper for 2013 -14 based on DEER Savings. |

# Section 1. General Measure & Baseline Data

## 1.1 Measure & Delivery Description

### 1.1a Measure Description

This measure is from DEER 2005 and replaces standard sprinkler nozzles with low pressure sprinkler nozzles.

Standard impact-driven sprinkler heads for agricultural irrigation use high water pressure (50+ PSI) and smoothbore nozzles. This configuration breaks the water stream into a distribution of small, medium, and large water droplets, which is desired for uniform water application to the area being irrigated. Low-pressure impact sprinkler nozzles use various orifice sizes (square, rectangular, octagonal, round with notches) and configuration to achieve the same water stream breakup at a lower operating pressure. Energy is saved by using a lower water pressure while maintaining the same water distribution.

The two measures in this work paper are both for low-pressure nozzles, but in different systems:

* Permanent solid-set systems: Sprinklers are in one place throughout a growing season.
* Portable, hand-moved systems: Aluminum or PVC pipe with sprinklers that can be moved from field to field, typically several times within a field during an irrigation cycle.

Table 1 Measure Names

|  |  |  |
| --- | --- | --- |
| Solution Code | Measure name | DEER Measure ID |
| PM-57328 | Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | D03-971 |
| PM-29652 | Low Pressure Sprinkler Nozzles - Portable Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | D03-970 |

Table 2 DEER Measure Description

|  |  |  |  |
| --- | --- | --- | --- |
| DEER Measure ID | DEER Measure Description | DEER Base Description | DEER Code Description |
| D03-971 | Low Pressure Sprinkler Nozzle - Solid set | Standard 50+ PSI impact-driven sprinkler heads | N/A |
| D03-970 | Low Pressure Sprinkler Nozzle - Portable | Standard 50+ PSI impact-driven sprinkler heads | N/A |

### 1.1b Delivery and Incentive Mechanism The Delivery and Incentive Mechanisms are:

### Financial Support / Down-Stream Incentive - Deemed

### Financial Support / Direct Install

### The Install Type is Retrofit (RET).

### 1.1c Measure Requirements

These measures are for all climate zones and for the building types in Table 9.

## 1.2 DEER Differences Analysis

These measures are included in DEER 2005 v2.01 [26], so savings and costs are taken from DEER. DEER 2008 and 2011 do not include these measures. The measures are listed as out-of-date in Appendix A-1 DEER Measure Database Updates Measure content, modeling method, model input parameter, and database format changes, last updated 19 November 2011, however the DEER05 data is still the most recent data available. Some climate zones and building types were not included in DEER 2005, so they were mapped from similar measures.

Table 3 DEER Difference Summary

|  |  |
| --- | --- |
| DEER Difference Summary Table | |
| Modified DEER Methodology | No |
| Scaled DEER Measure | No |
| DEER Building Prototypes Used | Yes |
| Deviation from DEER | Yes |
| DEER Version | DEER05 v2.01 |
| DEER Run ID and Measure Name (Sample) | CFRM01AVLPSHd Low Pressure Sprinkler Nozzle - Solid set |

## 1.3 Code Analysis

There are no code requirements for sprinkler systems used in agricultural irrigation.

Table 4 Code Summary

|  |  |  |
| --- | --- | --- |
| Code | Applicable Code Reference | Effective Dates |
| N/A | N/A | N/A |

## 1.4 Measure Effective Useful Life

DEER08 documentation provides EUL and RUL information to be used for the 13-14 program cycle on [www.deeresources.com](http://www.deeresources.com). The DEER documentation “Summary of EUL-RUL Analysis for the April 2008 Update to DEER” provides the RUL value as a flat 1/3 of the EUL value. The RUL value will only be applied to the first baseline period for retrofit measures that have applicable code that will affect the energy savings. In all other installation types and retrofit with no applicable code that affects the energy savings, the RUL is not applicable to either the first or second baseline period.

To obtain the EUL value the DEER08 documentation, EUL\_Summary\_10-1-08.xls [213], was consulted. Table 5 below identifies the value/methodology used for the measures in this work paper.

Table 5 DEER08 EUL Value/Methodology

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Market | Enduse | EUL\_ID | Measure | EUL (Years) | RUL (Years) |
| Ag | Irrigate | Agr-LPSNperm | Low Pressure Sprinkler Nozzles (permanent) | 5 | 1.67 |
| Ag | Irrigate | Agr-LPSNport | Low Pressure Sprinkler Nozzles (portable) | 3 | 1 |

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

The NTG value was obtained from the “DEER2011\_NTGR\_2012-05-16.xls” on the DEER website as required by Version 4 of the California Public Utilities Commission (CPUC) Energy Efficiency Policy Manual [132]. The relevant NTGR for this measure is shown in Table 6 below.

Table 6 Net-to-Gross Ratio

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NTGR\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID | NTG\* |
| Agric-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Ag | Any | All | 0.6 |
| Agricult-Default-HTG-di | All other EEM with no evaluated NTGR; direct install to hard-to-reach only. | Ag | Any | DirInstall | 0.85 |

\*Denotes that the column is taken from the DEER NTG Table.

The installation rate (IR) is identified in the calculation attachment. This value is obtained from a spreadsheet created by the DEER team titled “GrossSavingsAdjustments.xlsx”. The installation rate varies by end use, sector, technology, application, and delivery method. Spillage rate will also be applied to measures however the values will not be tracked in the work papers. The spillage rate will be tracked in an external table to be supplied to the Energy Division.

## 1.6 Time-of-Use Adjustment Factor

As directed by the CPUC in decision 06-06-063 dated June 29, 2006, time-of-use (TOU) adjustment factors are to be applied for residential A/C and commercial A/C (packaged and split-system direct-expansion cooling) measures only. Since this is not an A/C measure, the TOU adjustment factor is 0. Additionally, if a measure is assigned a DEER08 load shape, i.e. the load shape starts with “DEER:” the TOU assigned to that measure should also be zero.

Table 7 TOU Summary Table

|  |  |
| --- | --- |
| Measure | % |
| Low Pressure Sprinkler Nozzles | 0 |

\*Note: Check Section 3 if a measure appears to require a non-zero percentage but is assigned zero. If the load shape is a DEER08 load shape, a TOU of 0 is correct.

# Section 2. Energy Savings & Demand Reduction Calculations

Table 8 contains a data export for measures that are taken directly from DEER 2005. These results have not been modified and are only being included in the workpaper for reference.

DEER 2005 contains only the FRM building type and climate zones 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, and 13.

The savings for climate zones 6 and 8 are identical and are mapped (copied into) to CZ 9, 10, and 16. The savings for CZ 13 was mapped to CZ 14 and 15 since these are the hotter climate zones.

The FRM savings were mapped to Agricultural, Education – Community College, and Education – University.

Table 8 READi Tool Outputs

|  |  |  |
| --- | --- | --- |
| Solution Code | Measure Name | DEER05 Results |
| PM-57328 | Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads |  |
| PM-29652 | Low Pressure Sprinkler Nozzles - Portable Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads |  |

# Section 3. Load Shapes

The difference between the base case load shape and the measure load shape would be the most appropriate load shape; however, only end-use profiles are available. Therefore, the closest load shape chosen for this measure is the Ag & Water Pumping load shape. See Table 9 for a list of all Building Types and Load Shapes. See the KEMA report [31] for a more thorough discussion regarding the load shapes for this measure.

Table 9 Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| Building Type | E3 Alt. Building Type | Load Shape |
| Agricultural | Agricultural | Ag & Water Pumping |
| Education - Community College | Agricultural | Ag & Water Pumping |
| Education - University | Agricultural | Ag & Water Pumping |

# Section 4. Base Case & Measure Costs

## 4.1 Base Case Cost

Base case costs are from DEER 2005. For the permanent system the equipment cost is $0.90, and the labor cost is $0.84. For the portable system, the equipment cost is $0.90, and the labor cost is $0.34.

## 4.2 Gross Measure Cost

For RET, GMC is represented by the equation below:

*GMC = Measure Equipment Cost + Measure Labor Cost*

Gross Measure Cost is taken from DEER05. The measure case equipment cost in DEER05 appears to be incorrect because it is the exact same value as the labor cost. Therefore, instead of summing the equipment and labor cost to find the Gross Measure Cost, this work paper will use the “Installed Cost” from DEER05.

Table 10 Gross Measure Cost

|  |  |
| --- | --- |
| Measure Case Description | Gross Measure Cost |
| Low Pressure Sprinkler Nozzles - Permanent Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | $1.74 |
| Low Pressure Sprinkler Nozzles - Portable Irrigation replacing Standard 50+ PSI Impact-Driven Sprinkler Heads | $1.24 |

## 4.3 Incremental Measure Cost

For RET measures, the IMC is represented by the equation below:

IMC = (Measure Equipment Cost + Measure Labor Cost) –

(Base Case Equipment Cost + Base Case Labor Cost)

Since the Gross Measure Cost is the same as the base case cost (equipment + labor), the IMC for both measures is $0.00.

# Attachments



# References



[26]

[31]

[132]

[213]