**Work Paper SCE13PR004**

**Revision 1**

**Southern California Edison Company**

**Agricultural Milk Transfer Pump VSD**

# At-a-Glance Summary

|  |  |
| --- | --- |
| ****Applicable Measure Codes:**** | PR-59152 |
| **Measure Description:** | Installing a variable speed drive on a dairy farm milk transfer pump |
| **Base Case Description:** | A constant speed dairy farm milk transfer pump operating without a variable speed drive |
| **Energy Impact Common Units:** | per 1000 lbs. of milk |
| **Energy Savings :** | 0.466 kWh and 0.000079 kW |
| **Gross Measure Cost ($/unit)** | $0.41 |
| **Measure Incremental Cost ($/unit):** | $0.41 |
| **Effective Useful Life (years):** | 15 years |
| **Measure Application Type:** | Retrofit – Add on (REA) |
| **Net-to-Gross Ratios:** | 0.6 |
| **Important Comments:** | **This work paper document does not contain a data set in conformance with the 4/1/14 CPUC Ex Ante Database Specification; SCE will provide that data set separately.** |

# Document Revision History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Work paper and Revision # | Tech. Revision | MM/DD/YY | Author/Affiliation | Summary of Changes |
| SCE13PR004.0 | No | 4/17/2012 | John Rossi/EMCOR Energy Services | -New template for 2013-14 program cycle. |
| SCE13PR004.1 | No | 7/10/2014 | Vincent Partusch/SCE | -Template Update  -Work paper updated for the reporting period, effective 7/1/14 – 12/31/14. |

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

This work paper documents the E3 Calculator inputs and assumptions for installing a variable speed drive (VSD) on an existing dairy farm milk transfer pump. The base case is an existing constant speed dairy farm pump operating without a variable speed drive. See Table 1 for a list of the measures included in this work paper.

Table 1 Measure Names

|  |  |
| --- | --- |
| Solution Code | Measure name |
| PR-59192 | Agricultural Milk Transfer Pump VSD |

This measure is only eligible for existing operational pumps in an Agricultural building type located within an SCE climate zone. VSD installations on backup/standby pumps do not qualify for incentives. In situations containing multiple pump configurations, savings may be claimed for each pump VSD installed so long as the milk production (in 1000 lbs. of milk) is partitioned between pumps.

## 1.2 Technical Description

Dairy farm milk transfer pumps transport milk from the milking vacuum system to the bulk milk storage tank. Energy savings are realized as a result of the reduced speed of the pump motor. The energy savings in this work paper are provided on a per “1000 lbs. of milk” produced basis.

## 1.3 Measure Application Type

Note: See Appendix A for a comparison of the application types used by and incorporated into SCE systems versus the application types available in the newest revision of DEER 2014. Appendix A will serve as a translation between the outputs of this work paper and application types used by READi.

The delivery method is Financial Support / Down-Stream Incentive – Deemed. The measure type is Retrofit Add-on (REA).

## 1.4 Measure and Base Case Cost Effectiveness Data

### 1.4.1 DEER Measure and Base Case Analysis

Table 2 DEER Difference Summary

|  |  |
| --- | --- |
| DEER Difference Summary Table | |
| Modified DEER Methodology | No |
| Scaled DEER Measure | No |
| DEER Building Prototypes Used | No |
| Deviation from DEER | DEER14 does not contain this type of measure. |
| DEER Version | N/A |
| DEER Run ID and Measure Name (Sample) | N/A |

**Net to Gross**

The NTG value was obtained from the “DEER2011\_NTGR\_2012-05-16.xls” on the DEER website as required by Version 5 of the California Public Utilities Commission (CPUC) Energy Efficiency Policy Manual [351]. The relevant NTGR for this measure is shown in Table 3 below.

Table 3 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 | Any | 0.60 |

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

**Installation Rate**

The installation rate (IR) is identified in the calculation attachment. This value is obtained from the support table available in READi. Currently there is no versioning on the installation rate table. To address appropriate selection of the installation rate the date of the work paper will serve as the last date checked for updated IR values. The installation rate varies by end use, sector, technology, application, and delivery method. The relevant IR values for this measure are shown in Table 4 below.

Table 4 Installation Rate

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| GSIA\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID | GSIAValue\* |
| Def-GSIA | Default GSIA values | Any | Any | Any | 1.0 |

**Spillage Rate**

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.

**READi Technology Fields**

To support the development of the ED ex ante tables, select fields from the ex ante database will be identified in the work paper. For a full set of values associated with the measures in the work paper refer the Excel calculation template.

Table 5 READi Tech IDs

|  |  |
| --- | --- |
| READi Field Name | Values included in this workpaper |
| Measure Case UseCategory | Process Distribution |
| Measure Case UseSubCats | Pumping |
| Measure Case TechGroups | Pump System |
| Measure Case TechTypes | Adjustable Speed Drive |
| Base Case TechGroups | Pump System |
| Base Case TechTypes | Centrifugal |

### 1.4.2 Codes and Standards Analysis

There are no federal or state efficiency requirements that apply to milk transfer pumps. In addition, REA measures do not invoke code requirements.

**Table 6 Code Summary**

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

### 1.4.3 Non-DEER Study Review

### Ensave’s 2004-2005 Multi Measure Farm Program[A], prior data from past projects[B], and the California Dairy Statistics[C] were utilized to prepare the calculations in this work paper. Please see Section 2 and 4 for more information.

### 1.4.4 Measure and Base Case Effective Useful Life

DEER14 update documentation provides EUL and RUL information to be used for the 2013-14 program cycle on [www.deeresources.com](http://www.deeresources.com). The DEER documentation “DEER2014-EUL-table-update\_2014-02-05.xlsx” 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 DEER14 update documentation, “DEER2014-EUL-table-update\_2014-02-05.xlsx” [436], was consulted. Table 7 below identifies the value/methodology used for the measures in this work paper.

Table 7 DEER14 EUL Value/Methodology

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| READi EUL ID | Market | Enduse | Measure | EUL (Years) | RUL (Years) |
| Agr-VSDmilkTrnsfr | Non-Residential | Agricultural | Milk Transfer Pump Variable Speed Drive | 15 | N/A |

# Section 2. Energy Savings & Demand Reduction Calculations

## 2.1 Energy Savings and Demand Reduction Estimation Methodologies

Ensave’s 2004-2005 California Multi Measure Farm Program[A] provided data from previous projects where VSDs were installed on milk transfer pumps. Examination of the data indicates that the average

kWh and kW for this measure is 13,777 kWh and 2.34 kW for an average 29,572,648 pounds of milk production. Therefore, the normalized annual energy savings and demand reduction are calculated as:

Normalized Annual kWh Savings = 13,777 kWh ÷ 29,572,648 pound of milk produced

= 0.000466 kWh per pound of milk produced

= 0.466 kWh per 1000 pounds of milk produced

Normalized Annual kW Savings = 2.34 kW ÷ 29,572,648 pound of milk produced

= 0.000000079 kW per pound of milk produced

= 0.000079 kW per 1000 pounds of milk produced

The kW savings in this work paper assume that the milk transfer pumps operate during the DEER peak period.

Alternatively, if annual milk production in pounds is not available but the number of cows is known, the following assumptions can be made: According to the California 2011 Dairy Statistics[C], an average dairy farm has 1,101 cows with each cow producing 23,438 pounds of milk, on average, annually.

# 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 8 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 8 Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| Building Type | E3 Alt. Building Type | Load Shape |
| Agricultural | Agricultural | Ag & Water Pumping |

# Section 4. Base Case & Measure Costs

## 4.1 Base Case Cost

The base case is $0 because this measure is a discretionary modification to the customer’s existing equipment. The customer’s alternative option is to make no changes to the existing system.

## 4.2 Measure Case Cost

The costs for the milk transfer pump VSD measure are based upon actual kWh and costs from past projects in the Agricultural Energy Efficiency Program[B]. The results of this analysis are shown in Table 9 below. The “Total Equipment + Labor Cost” column includes a summation of individual projects that installed the VSD measure.

Table 9 Measure Costs

| Project Bundle # | | Climate Zone | Total Equipment + Labor Cost | Annual kWh Saved | Cost per kWh | Cost per Pound of Milk with conversion factor of 0.000466 kWh/lb. milk |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 10 | $7,427.58 | 40,072 | $0.185/kWh | $0.000086/lb. milk |
| 2 | 13 | $126,018.32 | 80,144 | $1.572/kWh | $0.000733/lb. milk |
| 3 | 13 | $25,365.92 | 60,108 | $0.422/kWh | $0.000197/lb. milk |
| Overall | - | $158,811.82 | 180,324 | $0.881/kWh | $0.000410/lb. milk |

As a result, the measure case equipment + labor cost is $0.41 per 1000 lbs. of milk produced. Please see Attachment #3 for more information.

## 4.3 Gross and Incremental Measure Cost

### 4.3.1 Gross Measure Cost

For **REA** measures, Gross Measure Cost (GMC) is represented by the equation below:

GMC = Measure Equipment Cost + Measure Labor Cost

GMC = $0.41 per 1000 lbs. of milk produced

See Attachment # 1 for the GMC breakouts by climate zone.

### 4.3.2 Incremental Measure Cost

For **REA** measures, Incremental Measure Cost (IMC) = GMC.

# Attachments

1.



2.



3.



# References

[31]

[351]

[436]



A. Attachment 2- EnSave CA 2004-2005 Multi Measure Farm Program for Milk Transfer

Pump VSD

B. Attachment 3-Cost Calculations Milk Transfer VSD 2007 and 2008 Work Sheet (past data

from prior projects in the Agricultural Energy Efficiency Program)

C. California Department of Food and Agriculture, California Dairy Statistics 2011, 2012

# Appendix A – SCE/ED Application Types

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SCE Program Type | ED Application Type | 1st Baseline Savings | 2nd Baseline Savings | 1st Baseline Cost | 2nd Baseline Cost | 1st Baseline Life | 2nd Baseline Life |
| New | New Construction (Nc) | Above Code/Standard | N/A | Incremental Cost | N/A | EUL | 0 |
| Replace on Burnout (ROB) | Replace on Burnout (Rob)/Normal Replacement (NR) | Above Code/Standard | N/A | Incremental Cost | N/A | EUL | 0 |
| Retrofit (RET) | Early Replacement (ER) | Above Cust. Existing | Above Code/Standard | Full Cost | Incremental Cost | RUL | EUL-RUL |
| Retrofit – First Baseline Only (REF) | Early Replacement RUL (ErRul) | Above Cust. Existing | N/A | Full Cost | N/A | EUL | 0 |
| Retrofit Add-on (REA) | N/A | Above Cust. Existing | N/A | Full Cost | N/A | EUL | 0 |