Short Form Work Paper WPSDGENRPR0005

**Revision 0**

**San Diego Gas & Electric**

**Energy Efficiency Engineering**

**Variable Frequency Drives on Agricultural Pumps**

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# SDG&E VFD on Agricultural Pumps

## Introduction

This short form workpaper documents the ex-ante load impact and cost-effectiveness values used for Variable Frequency Drives (VFD) on Agricultural Pumps. All of the units have been normalized per horsepower as cited by “PGECOAGR119 Rev 2 Variable Frequency Drives on Agricultural Pumps” workpaper.

## Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 01/17/2017 | Eduardo Reynoso /SDG&E | Adopted lead IOU workpaper “PGECOAGR119 R2 VFD Ag Pumps.docx” with all its assumptions and values. |

## Measure Summary

Table 1: Measure Summary Table

| **Section** | **Value** |
| --- | --- |
| **Summary & Purpose** | This short form workpaper documents ex-ante load impacts and cost-effectiveness values for Variable Frequency Drives on Agricultural Pumps. The energy savings and load impacts are based on the lead IOU workpaper file “PGECOAGR119 R2 VFD Ag Pumps.docx” for VFD on Agricultural Pumps for given measure codes:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Measure Codes | PGE | IR006 | IR007 | IR008 | IR009 | | SDG&E | 463776 | 463777 | 463778 | 463779 | | Measure Description | | VFD ON AG WELL PUMPS (<=300HP) | VFD ON AG BOOSTER PUMPS (<=150HP) | VFD ON NEW AG BOOSTER PUMPS (<=150HP) | VFD ON NEW AG WELL PUMPS (<=300HP) |   SDG&E takes no exceptions to PGE VFD on Agricultural Pumps workpaper. |
| **1.1 Measure & Baseline Data** | As cited per PGE workpaper “PGECOAGR119 R2 VFD Ag Pumps.docx”   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Measure Codes | PGE | IR006 | IR007 | IR008 | IR009 | | SDG&E | 463776 | 463777 | 463778 | 463779 | | Measure Description | | VFD ON AG WELL PUMPS (<=300HP)  Used for irrigation | VFD ON AG BOOSTER PUMPS (<=150HP)  Used for irrigation | VFD ON NEW AG BOOSTER PUMPS (<=150HP) used for Irrigation | VFD ON NEW AG WELL PUMPS (<=300HP) used for irrigation. | | Baseline Description | | Existing throttling valve for flow control of Ag pump. | Existing throttling valve for flow control of Ag pump. | In place of throttling valve for flow control of new Ag pump. | In place of throttling valve for flow control of new Ag pump. | |
| **1.2 Technical Description** | As cited per PGE workpaper “PGECOAGR119 R2 VFD Agricultural Pumps”. |
| Measures | |  |  |  | | --- | --- | --- | | Measure Code | | Measure Name | | PGE | SDG&E | | IR006 | 463776 | VFD ON AG WELL PUMPS (<=300HP), REA | | IR007 | 463777 | VFD ON AG BOOSTER PUMPS (<=150HP), REA | | IR008 | 463778 | VFD ON NEW AG BOOSTER PUMPS (<=150HP), NC | | IR009 | 463779 | VFD ON NEW AG WELL PUMPS (<=300HP), NC | |  | | | |
| Code for All Measures | As cited per “PGECOAGR119 R2 VFD on Ag Pumps.docx” lead IOU workpaper with no exceptions and summarized below:  ***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. |
| Requirements | As cited per PGECOAGR119 Rev 2 VFD on Agricultural Pumps:   * Customer must have electricity distributed by SDG&E to the installation address. * Customer must be under a SDG&E agricultural rate schedule. * Customer must have an existing electrically operated agricultural booster or well pump installed on site or customer is planning on installing a new agricultural booster or well pump. * Customer must install a variable frequency drive (VFD) on the pump motor. * VFD must be installed on a pressurized irrigation system (no flood irrigation). * VFD must be used for controlling the flow/pressure of the pump. * VFD is recommended to meet qualify requirements as specified by IEEE Standard 519-2014, Recommended Practices and Requirements for Harmonic Control in Electrical Systems. * Pumping application must currently have the means of varying the pressure/flow (i.e. throttle valve, control valve, etc.). * Minimum operation of 1,000 hours per year. * The VFD must NOT be used for the following pumping applications:   + A well pump used to fill a reservoir   + A well pump discharging directly into a canal   + A mixed flow pump (high volume, low head) * These rebates are provided for the purpose of installing VFDs on new or existing pumps. * The customer must supply an invoice or other supporting documentation that includes the quantity of VFDs, type (well and/or booster), horsepower rating of motor(s) and VFD(s), area map showing physical location of pumps, and the manufacturer make/models of the VFDs installed. |
| **1.3 Installation Type and Delivery Mechanisms** |  |
| Installation Type | * Retrofit Add-on (REA)   Full EUL granted to this REA measure since the pump may be replaced but the VFD controller and electrical termination remain. |
| Delivery Mechanisms | * Downstream Rebate – Deemed Rebate |
| **1.4.1 DEER Data** | As cited per “PGECOAGR119 R2 VFD on Ag Pumps.docx” VFD on Agricultural Pumps were PG&E is the lead IOU workpaper. |
| Net-to-Gross Ratio | All-Default<=2yrs  The lead IOU workpaper (PGECOAGR119 Rev2) was originally developed in 2014 but SDG&E is only now adopting it. |
| GSIA | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | GSIA | Description | Sector | BldgType | ProgDelivID | GSIAValue | | Def-GSIA | Default GSIA | Any | Any | Any | 1 | |
| Effective and Remaining Useful Life | |  |  |  |  | | --- | --- | --- | --- | | EUL ID | Description | Sector | UseCategory | | Agr-VSDWellPmp | Well Pump Variable Speed Drive | Ag | Irrigate | |
| **Section 2. Calculation Methodology** |  |
| Energy Savings/Peak Demand Reduction – All Measures | All Energy Impacts per “PGECOAGR119 R2 VFD on Ag Pumps” VFD on Agricultural Pumps workpaper.  Annual Energy Savings and Demand Reduction Values   |  |  |  |  | | --- | --- | --- | --- | | Solution Code | | Annual Energy Savings (KWh/HP/Yr) | DEER Peak Demand (KW/HP) | | PG&E | SDGE | | IR006 | 463776 | 256.60 | 0.1207 | | IR007 | 463777 | 226.65 | 0.1220 | | IR008 | 463778 | 226.65 | 0.1220 | | IR009 | 463779 | 256.60 | 0.1207 | |
| **Section 3. Load Shapes** | ElecImpProfile: SDG:35-OTI-OtherIndustrial-Ag\_Pump  GasImpProfile: Annual |
| **Section 4. Costs** | All cost adopted and cited from “PGECOAGR119 R2 VFD AG Pumps.docx” VFD Agricultural Pumps workpaper. |
| **Section 4.1 Modeled Costs** | All cost have been normalized per “PGECOAGR119 R2 VFD Ag Pumps.docx” Agricultural Pumps workpaper to reflect “$/HP” units. |
| Base Cost – Measure1 | $0.00  For this measure category, the base case cost is assumed to be zero given that the alternative is to make no changes to their existing system. |
| Measure Cost – Measure 1 | |  |  |  |  |  | | --- | --- | --- | --- | --- | | Product Code | | Labor Cost ($/HP) | Material Cost ($/HP) | Measure Cost ($/HP) | | PGE | SDG&E | | IR006 | 463776 | 26 | 163 | 189 | | IR007 | 463777 | 30 | 171 | 201 | | IR008 | 463778 | 30 | 171 | 201 | | IR009 | 463779 | 26 | 163 | 189 | |