

State of California



Memorandum

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CC:

From: Peter Biermayer P.E., Utilities Engineer, EE Planning & Forecasting Section, Energy Division, CPUC

Subject: Non-standard Disposition for Enhanced VFD on Agricultural Pump Measure Package, SWWP005-02

1. Discussion and Direction

The California Public Utilities Commission (CPUC) approves the measure package for Enhanced VFD on Agricultural Pump, SWWP005-02 for use during the 2022 and 2023 program years and sets an expiry date for this measure package of December 31, 2023. This measure package requires revisions with resubmission by June 1, 2022, to facilitate the measure package review and approval cycle for 2024-2025 implementation

2. Measure Package Summary

Pacific Gas & Electric (PG&E) submitted this new measure package on December 21, 2020. The review team posted preliminary review comments to the CPUC's Measure Project Archive (WPA) on February and July of 2021. The measure package was resubmitted on August 20, 2021.

Variable frequency drives (VFDs) are sometimes installed on irrigation pumps to enable adjustment of the pump speed and flow. Adding a VFD system to an over-designed pump will provide sufficient capacity in worst-case conditions as well as the capability of reducing the pump speed most of the time to avoid developing excess pressure and consuming excess electricity.

PG&E has incentivized "Tier 1 basic VFD systems" (SWWP002-02) and those rebates do not have any minimum performance standards requirement. Thus, in early 2017, Pacific Gas & Electric Company (PG&E) contracted with the Irrigation Training & Research Center (ITRC) at California Polytechnic State University (Cal Poly), San Luis Obispo to develop the technical specifications requirements for an enhanced VFD measure offering. The specifications requirement was included in a subsequent ITRC report, VFD (Variable Frequency Drive) Specifications for On-Farm Pumps.

The ITRC analysis revealed VFDs in pre-existing operations are rare and, although the number of VFD system installations is increasing, areas for improvement still exist. Most importantly, a specific agricultural VFD system performance standard has not been available, historically.

The ITRC analysis confirmed that without specifications requirements and special design attention, the Tier 1 basic VFD installations can be the source of power quality and radio interference issues. Notably, poor VFD system design can cause frequent nuisance tripping (automatic resetting or shutdowns) and may prevent the pump motor from starting. Without standards, mitigating or avoiding these issues for new VFD installations is optional, rather than obligatory.

The primary goal of the specifications requirements is to improve agricultural VFD installations for low voltage (≤ 480 VAC) well pumps (≤ 600 hp) and booster pumps (≤ 150 hp) by setting minimum requirements for high quality VFD installations. Detailed VFD specifications will increase energy efficiency, VFD life expectancy and reliability, and will decrease power quality issues.

Since the rollout of the ITRC technical specifications requirement for the enhanced VFD system, PG&E has received numerous requests from the industry to offer rebates for a lower-cost VFD system without sacrificing power quality. In response, a “Tier 2 mid-tier VFD system” was created, is now referred to as the “Tier 3 enhanced VFD system” (SWWP005-02).

3. Critical Review Issues

Updated information and analysis are required by June 2022 to support the Ex Ante savings values in the statewide measure package. The critical issues are:

- Pump operating profiles and participating farm metrics
- Industry standard practice baseline of farm irrigation pumps

3.1. Pump Operating Profiles and Participating Farm Metrics

The basis for pump operating profiles and participating farm metrics that supports this workpaper are secondary sources. It is unclear if these sources do an adequate job of representing current and future participants in this deemed measure offering. For example, do the calculations and assumptions reflect true participant operating hours, pump load profiles, crop types and acreage served per pump motor horsepower? Recent evaluation results suggest that improvement is needed.

Improved accuracy will require the use of participant primary data sources and pump performance models. CPUC reviewers believe that future workpaper updates can benefit from results and methods used to derived gross impacts under the Small/Medium Commercial evaluations for PY2018 and PY2019, and the upcoming PY2020 evaluation, with a final report and results due April 1, 2022. Roughly 40-50 pumps were modeled in each years’ evaluation. These results can be mined for use in workpaper updates.

Furthermore, the evaluation gross impact modeling approach makes use of models that are calibrated using AMI data. AMI data, often dedicated to a particular pump/utility account, ensures that the resulting models accurately account for actual pump runtime and the pump load distribution

across pump speeds. This produces highly accurate results/models. It might be possible for the PAs to build upon the evaluation dataset using a similar modeling approach.

The evaluation also presents various sample point metrics that might be mined for use in developing ex ante savings values for the measure package – such as annual pump run hours, peak coincidence factors, crop type, acres served, etc.

3.2. Industry Standard Practice Baseline of Farm irrigation pumps

There is considerable uncertainty regarding the conditions and situations under which VFDs are commonly installed and the market drivers that might trigger those installations. For example, how frequently are VFDs installed at the time of pump replacement vs. new pump installation vs. VFD add-on to an existing pump? VFDs provide a host of non-energy benefits that can lead to adoption, even absent program influence: telemetry, soft-start, maintaining constant pressure in the manifold and distribution lines, and reduced pump maintenance and extended life. The program-defined baseline where flow control is attained using a throttle valve does not necessarily reflect standard purchasing practices which may include VFDs under certain circumstances. An ISP update study is needed to ensure that future workpaper updates include a fully vetted understanding of baseline market practices.

4. Direction

Based on the critical review items, PG&E is directed to conduct the indicated research, revise the measure package, and resubmit for PY2024-2025 implementation. In order to ensure timely completion of the measure package, PG&E shall formulate and submit a revised measure package by June 1, 2022, once PY2020 evaluation results are available on April 1, 2022.

4.1 Mine Evaluation Results and Models to Best Inform Ex Ante Estimates

PG&E is directed to mine PY2018, PY2019 and PY2020 evaluation results and models to best inform ex ante saving estimates. In particular, the sample of calibrated models can inform pump operating profiles and pump load profiles. Furthermore, the models might inform differences in pump operations as a function of segment – for example crop type and acres served per horsepower.

4.2 Conduct ISP research

PG&E is directed to initiate and complete a study to determine industry standard practice (ISP) for agricultural irrigation pumps. This will be an update to an ISP study completed by PG&E several years ago. Importantly, ISP study updates should differentiate base case by pump size and pump type (booster vs. well) and market event (i.e., VFD add-on to an existing pump, pump replacement and new pump). PG&E shall offer CPUC reviewers an opportunity to review interim work products including the study scope of work, sample plan, survey instruments, and other pertinent details on proposed research activities.