

Executive Summary: Draft PA No. 7 – Pump and Motor Efficiency Improvement Program

Description

This assessment estimates the energy savings and GHG reduction potential of an accelerated program, over a proposed 1-year period, to evaluate all pumps in the SqCWD system and install cost-effective pump retrofits.

SCWD has recently replaced or retrofitted their large pumps based on 2008 PG&E pump efficiency tests and therefore is not included in this assessment.

Amount of GHG Reduction

This program would only count the GHG reduction associated with the acceleration of the pump replacement program. For example, assuming that pumps are replaced on average every 15 years through routine maintenance, an inefficient pump that is 6 years old would continue to run at an inefficient rate for another 9 years, wasting energy and creating additional GHG for those 9 years. If this pump were replaced, the energy savings and associated GHG reduction could only be counted as a GHG reduction project for 9 years.

The SqCWD pumps that have been identified as inefficient have remaining lifespans of between 3 and 12 years. However, because actual pump maintenance and replacement can be dynamic and influenced by other factors, the SqCWD operations staff is reviewing this PA and the identified pumps to confirm the assumptions herein. Any resulting changes to the pump replacement schedule assumptions will be reflected in the final PA.

The program could start out earning 49 MT CO₂e per year, would gradually decrease as more pumps reach their life expectancy, and would expire to zero after year 12. The average annual GHG reduction could be approximately 29 MT CO₂e per year, which is approximately 2% of the potential GHG reduction goals for SqCWD.

Project Life and Sustainability

As described above, because a pump and motor efficiency program is an acceleration of an existing program it is a temporary project and would expire after 12 years for SqCWD.

Project Cost

The project would cost approximately \$113,000 per year for the first five years (during loan repayment), and would cost approximately \$588 per MT CO₂e over the 12-year life of the project.

Table ES-1: Pump and Motor Efficiency Improvement Program Summary

| Project | Project Life (yrs) | Average Annual GHG Reduction (MT CO ₂ e/year) | Capital Cost Less Incentives (\$) | Average Annual Cost (\$/year) | Unit Cost (\$/MT CO ₂ e) | Space Required |
|---------|--------------------|--|-----------------------------------|-------------------------------|-------------------------------------|----------------|
| SqCWD | 12 | 29 | \$366,000 | \$30,000 | \$980 | None |

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Description

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Background

SqCWD relies solely on groundwater. The groundwater is pumped to the surface, treated, and pumped through the distribution system. The SqCWD pump database (included as Attachment 1) lists 18 well pumps and 11 booster pump stations in its water system. This assessment focuses on the larger, more-energy intensive pumps that are 50 horsepower (HP) or greater.

Current PG&E Pump Efficiency Testing: SqCWD provided a database of monthly pump and motor efficiency data that includes the latest replacement date, as summarized in Attachment 1. Seven of the well pumps had average annual efficiencies of less than 65% from July 2010 to June 2011, while the other 11 either had better efficiencies or were recently replaced.

Note: This assessment assumes that motors are not replaced as a part of this program. SqCWD has replaced all well pump motors within the last 10 years.

Description of Pump Efficiency Improvement Program: This program would accelerate and systematically replace many of the older or less efficient pumps over a 1-year period and would include the following elements:

1. Pump Efficiency Testing Database Update: The SqCWD database would be updated with any pump and motor upgrades that occurred after June 2011 or any additional efficiency testing.
2. Ranking/Prioritization of Pumps: The pumps would be ranked for replacement based on factors such as condition, necessity in the process train, redundancy, and cost.
3. Program Budget Determination: Based on the replacement cost analysis and the available resources and funding, an acceptable replacement budget and schedule would be established.
4. Replacement Schedule Coordination: Replacing the pumps requires coordination with water system operations to minimize disruption to the system. It may not make sense to perform replacements during periods of high demand.
5. Replacement of Pumps: Pump replacement would occur over a 1-year period and includes ordering and installation of new pumps and coordination with water system operations.
6. Disposal of Old Pumps: Old pumps that are replaced through the program would be discarded. Environmentally-friendly disposal methods, such as refurbishment or recycling, would be preferred.

7. Coordination of PG&E Reimbursement: Coordination with PG&E is required to receive the pump efficiency rebates. Information for PG&E's Energy Management Systems for Pumps and Pumping Systems and Advanced Pumping Efficiency Program are available online.

Vendors

Pump Vendors: Although the existing pump manufacturers are not listed in the database, it is anticipated that SqCWD would be purchase replacement pumps from similar manufacturers.

Pump Efficiency Testing: SqCWD uses PG&E's pump efficiency testing service.

Management of the Program: The pump efficiency improvement program could be managed by SqCWD or by an outside consultant. Staff involvement would be required to determine the budget and schedule, as well as during pump replacement implementation to coordinate with water system operation. The program manager would interface with SqCWD (if managed by an outside consultant), equipment vendors, and PG&E as needed to receive rebates.

History and Technical Maturity

This type of energy savings approach is proven and technically mature. The program does not implement a new technology, but utilizes the concepts of increasing efficiency and conducting preventive maintenance, which SqCWD already incorporates into its O&M plans.

Reliability and Operational Complexity

The planning phase of the project, which includes updating the pump database, budgeting, and scheduling, should not affect operation of the water system but requires SqCWD staff time. Replacing the pumps requires coordination with water system operations to minimize disruption to the system. It may not make sense to perform replacements during periods of high demand. It is anticipated that one FTE staff would be required for one year while pumps are being replaced.

Once the program is completed, it is anticipated that time dedicated to maintaining and repairing pumps would be reduced compared to pre-program levels.

Sustainability

Because of the concept of additionality, this program would only count the GHG reduction associated with the acceleration of the pump replacement program. Therefore, a pump and motor efficiency program is a temporary project and would expire after 12 years for SqCWD.

Local Considerations

Economy

Since the number of pumps potentially replaced is relatively small, the program would not create long-term local jobs, but would help local vendors in the short-term.

Environment

This program would reduce the energy consumption of SqCWD, but would not reduce local direct GHG emissions or reduce local waste.

Air: Electric pumps do create air pollution, but GHG emissions will be reduced due to the reduced amount of electricity used for the same purpose.

Land: Since this project involves replacing one unit with another of the same function and similar size, there is no impact on land.

Water: There is no impact on water quality.

Noise: Noise impacts could be lowered because of the new pumps.

Aesthetic/Visual: There is no aesthetic or visual impact.

Waste By-Products: Disposal of old pumps is the primary environmental concern for this project. Selling or donating for refurbishment or recycling of materials would be preferred over landfill disposal.

Energy Savings and GHG Reductions

This project decreases the consumption of energy and associated indirect GHG emissions of the SqCWD system.

Energy savings and GHG reductions from this program were estimated using the available information in the PG&E pump testing databases. Based on these calculations, SqCWD could save approximately 168,000 kWh per year, which results in an average annual reduction of approximately 30 MTCO₂e per year. However, since the replacement of SqCWD pumps have different remaining lives, the associated annual GHG reductions will decline over time. This project is estimated to reduce approximately 2% of the potential GHG reduction goals for SqCWD.

Table 1 provides a summary of the energy production and GHG reduction from a pump and motor efficiency improvement program.

Table 1: Estimated Energy Savings and GHG Reductions for Pump and Motor Efficiency Improvement Program

| | Program Life (years) | Annual Energy Savings (kWh/yr) | Average Annual GHG Reduction (MT CO ₂ e) ¹ | GHG Reduction over Project Life (MT CO ₂ e) |
|-------|----------------------|--------------------------------|--|--|
| SqCWD | 12 | 168,000 ² | 29 ² | 354 |

¹Based on 2009 PG&E emission factor of 641 lbs CO₂e/MWh.

²First year reduction is 49. The reduction of the program would decline over time as more pumps reach their estimated lifespan. See Figure 2 below.

GHG reduction credits only can be taken for an accelerated pump/motor replacement program. For example, the SqCWD San Andreas well pump was replaced 12 years ago, so we assume that the pump would be replaced again, due to deteriorating performance, in approximately 3 years as part of routine maintenance. (It is assumed that each pump would operate for 15 years after the last replacement date.) Therefore, a pump replacement program could take credit for the energy savings and GHG reduction only for three years. Table 2 shows the estimated energy savings and GHG for the life of the SqCWD project.

Table 2: SqCWD Pump Energy Savings and GHG Reduction over Time

| Yr | Estimated Annual Energy Savings by Pump ¹ (kWh/year) | | | | | | Total Estimated Annual Energy Savings (kWh/yr) | Total Estimated Annual GHG Offset (MT CO ₂ e/yr) |
|----------------------|---|---------|----------|----------|--------|-------------|--|---|
| | Aptos Creek | Ledyard | Madeline | Seascope | Garnet | San Andreas | | |
| 1 | 32,629 | 33,341 | 12,016 | 28,919 | 24,972 | 36,429 | 168,306 | 49 |
| 2 | 32,629 | 33,341 | 12,016 | 28,919 | 24,972 | 36,429 | 168,306 | 49 |
| 3 | 32,629 | 33,341 | 12,016 | 28,919 | 24,972 | 36,429 | 168,306 | 49 |
| 4 | 32,629 | 33,341 | 12,016 | 28,919 | 24,972 | -- | 131,877 | 38 |
| 5 | 32,629 | 33,341 | 12,016 | 28,919 | 24,972 | -- | 131,877 | 38 |
| 6 | 32,629 | 33,341 | 12,016 | 28,919 | 24,972 | -- | 131,877 | 38 |
| 7 | 32,629 | 33,341 | 12,016 | 28,919 | -- | -- | 106,905 | 31 |
| 8 | 32,629 | 33,341 | 12,016 | -- | -- | -- | 77,986 | 23 |
| 9 | 32,629 | -- | -- | -- | -- | -- | 32,629 | 9 |
| 10 | 32,629 | -- | -- | -- | -- | -- | 32,629 | 9 |
| 11 | 32,629 | -- | -- | -- | -- | -- | 32,629 | 9 |
| 12 | 32,629 | -- | -- | -- | -- | -- | 32,629 | 9 |
| Program Total | | | | | | | 1,215,956 | 354 |
| Annualized | | | | | | | 101,330 | 29 |

¹This table only includes the well pumps identified as inefficient. Attachment 1 contains the full list of SqCWD well pumps.

Cost

This section summarizes the estimated project costs. The supporting cost information is included in Attachment 2.

Capital Cost: The capital cost for this project includes:

- Replacement of pumps, including materials and installation.
- Resizing or replacement of original pump fittings and valves if incorrectly sized for new equipment or decrepit.
- Replacement of decrepit equipment pad, as necessary.
- Removal and disposal of old pumps.
- 10 percent markup for engineering costs and contingency.

The capital cost is estimated to be approximately \$385,000 for 6 pumps for SqCWD.

PG&E Incentives: PG&E offers incentives for pump replacement through the Advanced Pump Efficiency Program (APEP). The efficiency information in the SqCWD database was entered into the APEP Incentive Calculator, which can be downloaded on the APEP website <http://www.pumpefficiency.org/>, to determine the potential incentives available.

The calculator shows that SqCWD could receive approximately \$19,000 in pump efficiency rebates.

O&M Cost: A pump efficiency improvement program requires program administration, management of pump testing and task orders, and working with contractors during pump replacement. Staffing may increase by one FTE employee for the 1-year duration of the project.

In addition, the pump replacement program is estimated to save SqCWD approximately \$25,000 annually in energy costs.

Table 2 provides a summary of the costs, savings and incentives for a pump and motor efficiency improvement program.

Table 2: Pump Efficiency Improvement Program Costs and Incentives

| | Program Life (yrs) | Capital Cost (\$) | One-time PG&E Incentive (\$) | Capital Cost Less Incentive (\$) | Average Annual Cost ² (\$/yr) | Unit Cost (\$/MT CO ₂ e) |
|-------|--------------------|-------------------|------------------------------|----------------------------------|--|-------------------------------------|
| SqCWD | 12 | \$385,000 | \$19,000 | \$367,000 | \$30,000 | \$980 |

¹Assumes a 6% interest rate and 13% bond fees.

²For 5 years, assuming a debt repayment of 5 years. Includes energy cost savings.

Summary of Advantages and Disadvantages

Advantages:

- Lower energy cost for pumps
- Preventive maintenance would improve reliability by reducing the risk of water system disruptions
- Less maintenance time and cost after implementation of program

Disadvantages:

- A pump replacement program would only be a short-term GHG reduction project. GHG reduction credits can only be taken during accelerated program period after which other GHG reduction approaches would have to be considered.
- Higher capital cost during 1-year replacement period

References

Center for Irrigation Technology. Advanced Pumping Efficiency Program: <http://www.pumpefficiency.org/>

Pacific Gas & Electric. Energy Management Systems for Pumps and Pumping Systems. <http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/agriculture/agPumping.pdf>

Attachments

Attachment 1 – SqCWD Pump and Motor Testing Database

Attachment 2 – SqCWD Cost Estimate