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September 30, 2011

To: The SCE ISP evaluation team
SCE

From: Dennis Rowan, PE
ASW Engineering

Re: Investigations of Energy Efficiency Measures and Industry Standard Practice
[Well Water Pump Upgrade Projects]

Dear ISP team,

ASW has conducted a review of the Well Water Pump Upgrade Projects and recommends that SCE considers that this measure is industry standard practice.

PROJECT BACKGROUND

The management of SCE has requested that ASW perform an investigation into the incentives issued for well-water pumping efficiency improvements that are associated with well pumping systems. While the initial request was focused on relocated wells only, the results of the investigation led to the inclusion of wells that were not relocated also. This document provides ASW's discovery, comments, and recommendations derived from the two projects that were provided as examples.

The purpose of hydraulic efficiency testing is to evaluate the efficiency of the pumping equipment. The results of the test are used to calculate the cost of pumping a volume of water, taking into account the depth of the well, the draw-down, and the condition of the pumping equipment.

EXAMPLE PROJECT A HISTORY

A hydraulic efficiency test was conducted on a well identified as Project A near Tulare, California. The test results indicated that the pump had degraded and was now relatively inefficient compared to new or rebuilt equipment and that the site could benefit from a pump replacement/refurbishment. Energy and demand savings were calculated and used to identify an energy efficiency incentive opportunity available through the Agricultural Energy Efficiency Program (AEEP).

The application for the AEEP was submitted to the program administrator for review and approval. After the SCE team reviewed the application, an approval letter was sent to the project sponsor from the program manager indicating the amount of incentive reserved and the estimated energy savings. The approval letter also indicated that the customer needed to sign the agreements and return the signed copies to SCE to be countersigned as soon as possible. The customer was instructed to wait for a countersigned agreement before proceeding with installation of the project.

The customer signed the agreements and returned them to SCE and SCE countersigned the agreements.

The customer informed SCE that the old well had been abandoned and the new well had taken its place. The notification also indicated that the new well location was far enough from the old well for SCE to assign the new well a different address from the old well. Subsequently SCE received the Project Installation Report

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(PIR). The PIR included the invoice for the new pump assembly but did not include the cost of the new well bore and casing.

After SCE review of the PIR, SCE notified the project sponsor in an Installation Report Review that the project incentive was declined since the new pump did not replace the existing pump. It was determined by the reviewer that the new pump at the new location presented a baseline issue since the data on the old pump did not represent the performance of the old pump at the new location. Since there was no operational base case, the project was not considered a retrofit project and was determined to be ineligible for incentives under the AEEP.

ASW's review of the original pump test and the installation invoice revealed that the existing pump had a pumping water level of 125 feet with a total head around 140 feet with a motor input power near 40 HP. The new well used a 140 foot 1-3/16"x2 Tube Assembly and a 40 HP motor. The baseline pumping system was determined to operate near 48% efficiency. The two are similar in construction and share characteristics that indicate that the baseline may apply to the new well site since the area is a large flat farming valley that does not vary significantly.

The installation report documents that the existing equipment was removed from service.

EXAMPLE PROJECT B HISTORY

A hydraulic efficiency test was conducted on a well identified as Project B. This test showed an overall plant efficiency around 57% efficient on a well with a 250 HP motor. While this is a reasonable efficiency for an agricultural plant, a metropolitan plant has more reliability issues and does not want to operate at significantly reduced efficiencies. Operating at reduced efficiencies could lead to failures and reliability is a primary concern for these types of plants.

An application was submitted to the Agricultural Energy Efficiency Program (AEEP). That application indicated that this site intended to locate an additional well, located away from the existing well that would serve the same loads as the existing well. The application also indicated that the existing well would remain in place as a back-up reserve well to the new well.

The new well was also being located where the well would only need to raise the water some 300 feet instead of the nearly 650 feet required at the existing well location. The flow capacity was also to be increased from 950 GPM at well to 1250 GPM at well.

METHODOLOGY

ASW called and interviewed a representative of a well known pump company. The representative indicated that a typical unadjusted useful life would be approximately 8 years for a pump, and that would vary based on the age of the well. Older wells would cause the pump to wear sooner by allowing more abrasive material into it over time. This age factor could adjust the expected useful life downwards by as much as a year. Some pumps have been known to operate for 10 to 12 years, but these end up operating at a very inefficient state.

Also interviewed was another representative of an alternative pump company. This alternative contact indicated that the wells cost for the rebuild was high and the cost for the removal and replacement was also high. Parts for the old pumps can also be difficult to find since the old pumps may not be manufactured any longer. The older pumps were also not designed for the current water conditions (water level, sediment, etc.) and a new

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pump could be matched for the current conditions. He estimates that 98 of 100 units removed from wells are replaced with new and not rebuilt or refurbished ones. He further explained that when purchasing a new pumping plant, the customer is presented with fairly limited options for efficiency that are based on water depth and other current, and perceived future, conditions. For example, if the water table can shift between 150 and 200 feet, the plant needs to function at 200 feet and should be designed to operate most efficiently at the expected levels that are most likely. It is as much an art as a science.

The final interview was with the Project A pumping customer. The customer indicated that his well was originally drilled in 1937 and the current pump was installed approximately 15 years ago. When asked about the condition of the baseline pump at the time it was abandoned, he indicated that it was pumping water, but that there was a lot of sand in it and the bowls were worn. He further indicated that they knew that they needed to replace the well and pump since the well casing was allowing the sand into the well. The new well was drilled near the road so that he would not need to traverse the field to access and activate the pump. The new well was drilled 500 feet from the original well site. He further indicated that the water table in the area was very consistent and the relocation did not alter the well height. When asked about his decision process when deciding to move forward with the project, he stated that the SCE pump test was an influence for him to get a more efficient pump system. He indicated that it was the thing to do. He also stated that he did not consider any other options when he installed the new well and the one he installed was the one suggested by the pump company as the best match for his well conditions.

ASW also reviewed an April 1999 ACEEE publication titled, “We’ve Been Testing Water Pumps for Years – Has Their Efficiency Changed?” The paper presents selected results from the analysis of over 28,000 pump tests performed by SCE between 1990 and 1997 through its Hydraulic Services Program. The study covered agricultural (irrigation) and municipal (water supply) customers. The study population was fairly equally distributed between these two distinct users.

ASW presents the following matrix of factors for your consideration regarding the Blow Molder Controller Retrofit Project:

Table 1: Factors indicating Industry Standard Practice

Factors Indicating Industry Standard Practice	Significance (1 – 3) 1=low, 3=high	Significance Explanation
As pumps age, their usefulness declines and they require replacement or rebuilding.	1	These pumps have a finite life and their replacement or rebuilding is imminent.
The customers purchase new plants instead of moving the existing equipment into new wells.	2	The likelihood of a site putting an old pump down into a new well is very low and it is nearly always the case that a new pump is placed into a new well.
Typical installations replace the pumps instead of rebuilding them.	2	Experts indicate that 98 out of 100 times a pump is removed from a well, a new one is installed. Rebuilding is a rare occurrence.
New pumping or rebuilt systems are inherently more efficient than their existing counterparts due to the newer designs and their design	2	The efficiency improvement was a result of the pump change or rebuild.

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matching the current conditions.		
New wells are typically drilled as a matter of necessity and not for efficiency.	1	The cost of a new well is very high and the financial benefit that will result from the energy efficiency that might be realized as a result of relocating a well is not a significant factor.
New or rebuilt pumps are re-inserted into the well once the pump is removed. The efficiency gain is tied to the old pump being replaced with a new or rebuilt pump.	3	The likelihood of the old pump being placed back into the hole is minimal.

Table 2: Factors indicating Non-Industry Standard Practice

Factors Indicating Non-Industry Standard Practice	Significance (1 – 3) 1=low, 3=high	Significance Explanation
The customer typically acts after the site receives a pump test which is the beginning of the project timeline.	1	Since the project timeline begins with the SCE pump test, the program influence can be justifiably assigned to the SCE program and tied to the pump test as the trigger.
The existing plant was operational when abandoned and replaced by the new plant.	2	These types of plants are typically operated until they are not functional or until they are barely functional.
The 1999 ACEEE study concludes that both motor and overall plant efficiencies were found to increase at a greater rate at those sites which received utility rebates	2	Since rebated sites showed a stronger rate of increase in overall plant efficiency, the program influence can be cited as a factor in the improved efficiency.

The factors in Table 1 indicating the measure is Industry Standard Practice (ISP) outweigh the factors in Table 2 indicating the measure is not Industry Standard Practice. The primary consideration being that the efficiency gain is tied to the removal of the pump from the well and not the decision to rebuild or replace the pump. Since these wells were relocated, the new pumps were a statistical inevitability. Even though the customer may not need to upgrade the pump and could place the existing pump into the new well, Industry Standard Practice for this type measure is to place new pumps into new wells. Furthermore, when considering wells that are not relocated, the conclusion remains the same allowing for pump rebuilding. Once a pump is removed from any well, the new or rebuilt pump is placed into the well upgrading the efficiency. The likelihood of the existing pump being placed back into the well without rebuilding is negligible.

The fact that a well was relocated constitutes grounds for disallowance of this measure. The industry experts interviewed as part of this study have indicated that when a well is moved, there is little chance that an existing pump will be placed into the new well. Since a new well is almost synonymous with a new pump, there seems to be little grounds to justify any incentive for any efficiency improvement that occurs as a result of moving the well. Since the new pump was going to be installed into the new well, the incentive is not clearly justified and may be disallowed upon third party review.

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CONCLUSIONS

ASW recommends that SCE considers that this measure is industry standard practice. Since there is little chance that an existing pump will be placed back into a well, it is ASW's opinion that any efficiency gains associated with replacing the pump are industry standard practice since the pump replacement was almost inevitable as soon as the decision was made to pull the pump.

ADDITIONAL CONCLUSIONS

- Additional Measure – New or Rebuilt Pump in Existing Well
 - ASW recommends that SCE consider any new or rebuilt pump as Industry Standard Practice regardless of the well, new or existing. Our research has indicated that these replacements are planned and occur regardless of incentives. Since there is little chance that an existing, unimproved, pump will be placed back into a well, it is ASW's opinion that any efficiency gains associated with replacing the pump are industry standard practice since the pump replacement was almost inevitable as soon as the decision was made to pull the pump. The decision to pull the pump can be tied to the pump test.
- Pump Test Energy Savings – Can They Be Counted
 - ASW recommends that SCE pump testing be considered the driving force behind any incremental improvement in energy efficiency associated with the new or rebuilt plant/pump measure regardless of whether it is in a new well or not. Our research has shown that it is the pump test that is the driving force behind the customer's activity.
 - The pump test program can be credited with the energy savings that occur as a result of these installations and not the relocation of a well or any specific decision to install a new or rebuilt pump. The decision to install a new or rebuilt plant or pump has typically been made as a result of the pump test. After the pump is removed from the well, and the well is inspected, then there may be a decision to relocate the well, but the decision to replace or rebuild the pump/plant has already been made.
 - The pump test is offered to the customers and as such it is part of the incentive offered by the AEEP. Without this offering from the program, the customers would not have the visibility into their wells and they would not know how efficient or how "healthy" their wells were.
 - Since the pump test is offered to the customers free of charge, and these customers are making decisions based on the results of these tests, the energy savings that result from the actions that are triggered by periodic pump testing may be claimed by the AEEP directly and no additional incentives are required to the customers to generate these energy savings. These customers are acting on information provided to them through the pump tests that were provided to them by the AEEP. That information is more valuable, in many cases, than the incentives that they receive for the energy efficiency realized.

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- o If not already occurring, the AEEP could count these energy savings if there were some feedback as to which of these pump tests triggered a plant replacement or rebuilding. If there is a replacement or rebuilding, then the energy savings calculated during the pump test may be claimed by the program as program influence. The ACEEE study clearly indicates that the pump test program participants have a greater increase in energy efficiency than those sites that do not participate in the program.
- o Since the program will require notification of new or rebuilt pump installations, in order to quantify energy savings related to program activities, an incentive to the customers who install new or rebuilt pumps will be necessary. This incentive can be minor in nature and needs only be sufficient to provide the customer with incentive to complete the simplified application. Something on the order of a fixed payment of \$500 - \$1,000 based on HP, or a scale based on \$0.005/Hp-Hr (about \$0.03/kWh assuming a 20% gain) would likely suffice.

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