EARLY OPINION (EO) REQUEST FORM V3

The information provided in this request form will be used to request an early opinion from CPUC staff.

Program Administrator (PA) may request an EO review on projects in the development stage that are not ready for full project review. EO requests may include any aspect of project development, such as policy question, appropriate baseline, calculation techniques, preponderance of evidence documentation, program influence, and so on. EO requests may reference a specific project or cover issues relevant to multiple projects.

EO requests must be in the form of a set of specific questions with the PA first stating clearly the issue(s) or the policy 'gray-area'. The PA is expected to provide its opinion/thought on the 'gray-area' issue then specifically ask on what it wishes to ask the CPUC Staff (CS).

Early Opinion Information	
EO Title	Pump Overhaul Clarification
EO Tracking Number	EO-033
EO Reviewer(s)	[redacted]
EO sharing requested	☐ PA ☐ CPUC

Date Tracking	
Submission Date	5/17/2023
PA Response Date	6/20/2023
PA Response 2 Date	9/18/2023
CS Response 1	6/15/2023
CS Response 2	7/20/2023
CS Response 2	11/7/2023
Completion Date	

EO Requestor			
PA / Third Party Implementer	SCE [redacted]		☐ Gas / ☒ Electric
Department			
Contact Name(s)	[redacted]	Telephone #	

	[redacted]		
Contact Email(s)	[redacted]		
Program Name	SW WISE™ – Statewide Water Infrastructure System Efficiency™ Program		

EO Questions (add rows as needed)
Third Party Implementer/PA EO Question 1. The SW WISE program is seeking EO from CPUC staff on the implementation of pump overhaul measures within the program. This EO specifically consists of three policy items – each being submitted as a separate question – that the PA needs clarification on. These items have been adopted from different resolution/guidance documents and are listed below: 1. **BRO Measure Application Type - Scope of Work for Pump Overhaul Measures** – Resolution E-4818[1] 2. **Eligibility of Program Influence** – Resolution E-5115[2] The SW WISE program seeks verification and confirmation of [redacted] understanding of the guidelines to determine the eligibility and scope of work for pump overhaul opportunities. These are detailed as questions #1 - #4 in this EO document. The original program design is based on the guidelines specified from Statewide Custom Project Guidance Document, existing CPUC dispositions, Resolution E-4818, and [redacted] engineering expertise in the segment from [redacted] years of experience with pump overhaul projects in the water, wastewater, oil, gas, and irrigation industries. Over the [redacted] years working with over [redacted] customers in California, [redacted] has identified many pump overhaul opportunities. For example, in just PG&E service territory alone, [redacted] has benchmarked [redacted] pumps for over [redacted] different customers, and through this have recommended overhauls for [redacted] pumps. Statewide (within PG&E, SCE, and SDG&E service territories), [redacted] has identified over [redacted] electric pumps with opportunities for pump overhaul through benchmarking existing customer data and analysis of pump tests. Out of these identified pump overhaul opportunities, only [redacted] pumps with overhaul scope were submitted in [redacted] developed project applications following influenced customer agreements to move forward with the overhaul scope of work. However, only [redacted] of these [redacted] influenced pump overhauls were installed and paid incentives. Please note, this means only [redacted] of the pumps benchmarked for overhaul, and eligible for incentives, were verified and completed with incentives disbursed. The EO in this document is aligned with [redacted] understanding of the referenced policies and guidance document, and are aligned with SW WISE Program's Implementation Plan (IP). For EO question 1, [redacted] seeks CPUC confirmation the pump overhaul guidelines to be adopted for implementation in the SW WISE Program is consistent with incentivized custom project policies.

1 E-4818 Resolution

2 E-5115 Resolution

3 – [redacted] EO 33

PA Opinion/Proposed Response to EO Question 1. (must be filled in)

PA Opinion/Proposed Response to EO Question 1. (must be filled in)

Department Of Energy (DOE) defines “pump” as equipment designed to move liquids (which may include entrained gases, free solids, and totally dissolved solids) by physical or mechanical action, includes a bare pump, and, if included by the manufacturer at the time of sale, mechanical equipment, driver, and controls.

The figures below show the bare pump and mechanical driver components of a pump for context:

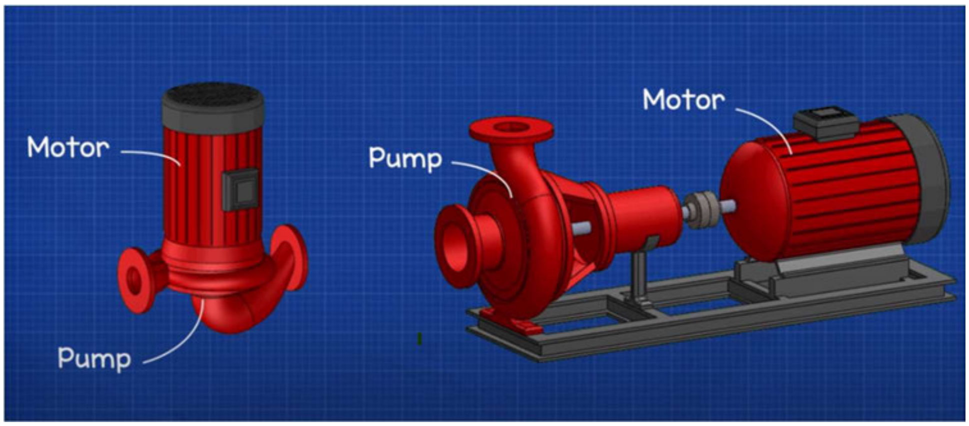

Fig 1. Pumping System Components (Source: Engineers - The Engineering Mindset)

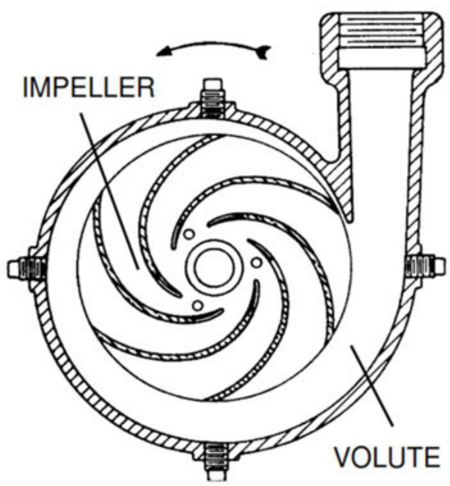

Fig 2: Pump Volute and Impeller (Source: A Brief Introduction to Centrifugal Pumps by Joe Evans, PhD)

Volute: Volute is the outer casing which consists of impeller and converts velocity into pressure

Impeller: Impeller a rotating component of pump made with vanes or blades used to create velocity through rotation.

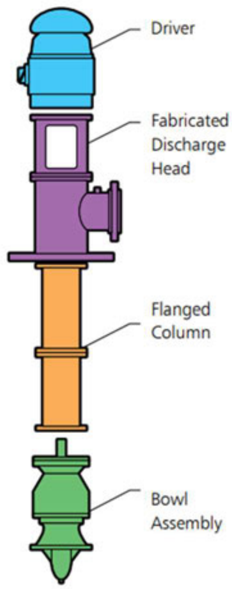

Fig 3: Different Components of a Vertical Turbine Pump (Source: [VIT Vertical Industrial Turbine Pumps | Goulds Pumps])

Bowl Assembly: Bowl Assembly is typical in a Vertical Turbine Pump and consists of the suction case or bell, the impellers and the diffuser style casings.

The below figure, Figure 4, shows the pump equipment contributing to the OPE and a visual representation of system components to evaluate when implementing this measure. The major losses in a pumping system typically occur at the pump bowl assembly and thus offer a huge potential to be rectified for increasing the pump efficiency. A retrofit of the impeller and bowl assembly (i.e., the optimal replacement of the bowls) of a pumping unit relative to the water level in the operating aquifer can improve the pump efficiency. Proper adjustment of the impeller relative to the bowl assembly will minimize the clearance between impeller and bowl and maximize the quantity of water pumped.

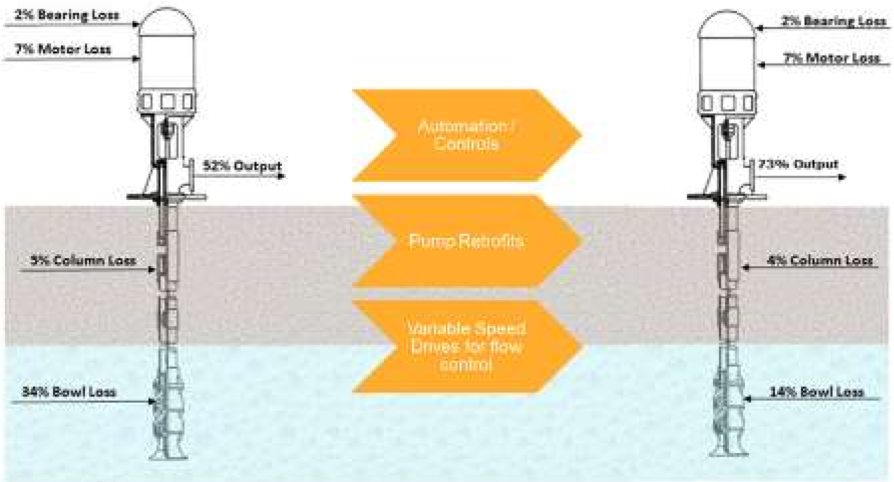

Figure 4 – Pump Efficiency Improvement Example

The proposed pump overhaul guidelines for the SW WISE program are as follows:

1) **Pump Overhaul Scope of Work-**

a. The specific work for a pump overhaul may include at least one of the four items below (measure eligibility will be determined by the SW WISE program on a project-by-project basis):

i. Replacement of either or both pump's bowl/volute assembly and impeller, or

ii. Machine work (e.g., re-facing, pit and hole filling, replacing wear rings) to return either or both pump's bowl and impeller to original condition, or

iii. Trimming of impellers, or

iv. Addition or removal of a stage, and/or

v. Complete pump replacement in accordance with CPUC Early Opinion Response dated 10/03/2019, complete pump replacement is allowed to be treated as a BRO measure with a default EUL of 3 years. The pump replacement must meet the existing pump's service level requirements. This includes replacement of the entire Pump as defined by eCFR :: 10 CFR 431.462 – Definition of "Pump", which includes the bare pump (pump bowl and volute assembly and impeller) and mechanical equipment (tube and shaft), driver (motor) and controls (VFD or variable clutch drive).

2) A pump test will qualify as pre-inspection within 1 year of program application submission.

3) In cases where customer provided data is insufficient to establish the baseline efficiency (either overall plant efficiency (OPE) or normalized energy intensity (kWh/Acre ft.)), the most current pump test shall be used to establish the baseline and the post-overhaul efficiencies to calculate the savings.

4) A 3-year Effective Useful Life (EUL) is the assumed default value per Resolution E-4818's requirement for BRO measures. In accordance with the statewide Custom Project Guidance Document available via https://www.cpuc.ca.gov, custom project's EUL must be greater than the Simple Payback Period.

If a custom project's Simple Payback exceeds its EUL, please contact your assigned SW WISE Program Representative. Projects may receive additional review on a case-by-case basis.

5) A historical review of pump test history, multiple years of utilities billing history, and any other available information shall be used to establish the projected baseline and installed savings - if available.

6) Failed pumps, or pumps not able to meet the customer's service level requirement, are not eligible for incentives.

7) The following are baseline energy savings considerations to review, validate or correct Annual Acre Ft. DemandBase:

a. 3 to 5 years of utility billing history to provide usage profile to verify the proper Annual Acre Ft. DemandBase that will be used as the applied constant for pre and post energy efficiency calculations.

b. For multiple pump and variable operation, up to 12 months of Customer SCADA (Supervisory Control and Data Acquisition) Data, up to 12 months of Customer logs (hour clock reads), or data logging will be conducted in accordance with the approved M&V (Measurement & Verification) plan (to reconcile pump usage to utility billing if needed).

c. Review of historical pump tests and audits to provide insight on the energy usage splits for multiple pumps as well as provide a trend for general degradation or lack thereof over an extended period - if available.

d. Review of existing pump's performance curve - if available (historical pump tests to provide insight into cause of pump inefficiency).

e. If there are expected changes in future operations where Annual Acre Ft. demand will be different from historical Annual Acre Ft. demand, additional documentation will be collected to determine the customers' future operation. Some examples of this additional documentation include water management Plans, or changes in water rights/allocations, and city planning for future expansion. Any change in normalized Annual Acre Ft. will only be eligible if the existing pump could have met the service level required, which will be checked with the existing pump's curve. The service level required is defined based on the pump productivity.

As a simplified example, consider the following:

Baseline AF/yr: 1,500 AF/yr

Baseline AOH : 3,000 hrs/yr

Baseline OPE: 50%

Post-Install AF/yr: 2,000 AF/yr (verified in the IR or if the project is in PA, supported with additional documentation)

Post-Install OPE: 70%

In this simplified example, the existing baseline pump would have been able to meet the service level required through an increase in annual hours of operation. Without the intervention of the program, the customer would have continued to meet the water demands of 2,000 AF/yr by increasing the hours of operation of its inefficient pump (running at 50% OPE) to 4,000 hrs/yr.

Please note that this would only apply for cases where the existing baseline pump is able to meet the increase/expected increase in pump productivity.

8) The installed energy saving considerations and post-installation energy savings validation plan are project specific, should be identified in the M&V Plan, and includes:

Table 1: Data Collection for Post-Install M&V

Post Pump Test	Required, if no customer SCADA data is available to verify energy savings.
Analysis and review of pump performance curves	Required
Data Logging	Required if billing history does not isolate pump usage and there is subsequently no SCADA data or customer logs (hour clock reads) are available. Data logging of power, flow, and pressure isolated to the overhauled pump shall be conducted to determine baseline and installed energy usage.
Annual Acre ft. demand determined through historical analysis and post customer usage. Expected variations to be normalized for post installation water demand	Required; post-install SCADA or post-pump test to be collected to normalize for post installation water demand. Normalization must be performed if water demand is more than +/- 10%.
Well depth variation impacts to kWh/Acre ft. used to normalize energy savings	Required; post-install SCADA data or post-pump test to be collected to normalize for post total dynamic head (TDH). Normalization must be performed if the TDH is more than +/- 10%.
Data comparisons/analysis to pump performance curve (required for post energy savings analysis)	Required as follows: 1) Analysis performed on post-install pump curve to show increase in OPE

	2) Analysis performed on pre-install pump curve to determine nominal baseline efficiency
Post installation billing history	If available
Post installation SCADA Data	If available
Post installation customer logs of hour clock reads	If available

9) For instances of pump seasonal or operational variations, the baseline and installed kWh/Acre Ft (energy costs) as well as the Acre Ft. Demand must be normalized. (E.g. environmental conditions, new crops, multiple pump applications, change in pump sequencing, variations in water demand). This analysis will be included in the Installation Report and M&V Plan. (See the above table for M&V requirements.)

Pump Overhaul Measure Calculation Methodology:

<u>Energy Savings (kWh)</u>

Energy Savings (kWh) = (Annual Acre Ft. DemandBase * (kWh/Acre Ft. Base – kWh/Acre Ft. Post))

Annual Acre Ft. DemandBase = Annual Acre Ft. pumped as derived through pump test and/or customer SCADA data

kWh/Acre Ft. Base = Derived through baseline pump test or available SCADA data

kWh/Acre Ft. Post = Derived through post pump test or available SCADA data

Normalization must be performed if water demand or total dynamic head (TDH) is more than +/- 10% different in the post-install when compared to the pre-install conditions.

<u>Demand Reduction (kW)</u>

Demand savings cannot be included for any project unless actual kW reductions can be verified through individual pump or multiple pump (i.e., booster stations) performance data (a combination of either pre and post 15-minute interval data, data logging, or SCADA system data.

SCE agrees with [redacted] pump overhaul guidelines based on information provided above and it aligns with SCE's understanding at the time of EO-01 was approved.

(If Needed) CPUC Staff Clarifying Question(s) to PA
(If Needed) PA Response to CPUC Clarifying Question(s)

CPUC Response (6/15/2023 and 7/15/2023)

Pump overhaul scope: The program holds the responsibility to accurately categorize program activities as either overhaul (BRO) or replacement based on the specific scope of the project. The categorization depends on the extent of the refurbishment/overhaul work performed. For instance, if the project scope includes the replacement of the pump impeller, bowl, and the motor after the pump has been pulled, the project should be categorized as a replacement project. In such cases, given circumstance leading to a pump being pulled, Normal Replacement (NR) is the appropriate measure application type and savings should be calculated based on the standard practice.

Alternatively, if the overhaul scope includes activities such as re-facing, pit and hole filling, or the replacement of either the pump impeller or the bowl, the project can be deemed a valid overhaul project. However, it remains crucial for the program to verify that the pre-existing pump meets the expected level of service required by the customer.

Below we have provided some additional guidance based on the potential overhaul scope identified by the program in items i through v but would like to emphasize that the final determination should be done based on the actual scope of the project and whether the existing pump was able to meet the service level requirement.

i. Replacement of either or both pump's bowl/volute assembly and impeller

The feasibility of replacing components such as the pump bowl (or volute or casing), impeller, and motor separately depends on the specific type and design of the pump. In certain pump types (e.g., close-coupled pumps, submersible pumps, magnetic drive pumps, etc.), the bowl, impeller, and motor are integrated as a single unit and cannot be separated. Therefore, for these pump types, it is not recommended to target them for pump overhaul projects, as the entire unit would often need to be replaced. Instead, such projects should be categorized as NR, involving the replacement of the entire unit, including the pump bowl, impeller, and motor.

On the other hand, there are pump types (e.g., split case pumps, inline pumps, multi-stage vertical turbine pumps) where it is possible to replace the pump impeller and bowl separately from the motor. In these cases, pump overhaul projects can be pursued, focusing on the replacement of the specific components that require upgrading or maintenance.

Provided below are some general examples/guidelines based on pump types. It is important to reiterate that for any valid pump overhaul activity, the existing pump must meet the service level requirement as expected by the customer.

- **Close-coupled pumps**: These pumps have the motor directly mounted onto the pump, creating a compact unit. In close-coupled pumps, the impeller and casing are typically integrated as a single unit and cannot be separated. For close-coupled, it is often necessary to replace the entire pump assembly, including the motor and pump components to ensure compatibility and proper functioning of the pump system. If the pump assembly, including the impeller, motor, and housing, needs to be replaced, this is often available as a complete unit from the manufacturer or distributors and the entire pump assembly can be swapped out as a single component. These types of replacements should be classified as NR and should not be allowed under BRO. In some close-coupled pump designs, the impeller can be replaced separately while keeping the motor and housing intact. This can be allowed under BRO but should be supported with project documentation showing only replacement of one component. The possibility of this should be evaluated based on manufacturers' specs before the project. The existing pump should be able to meet the service level requirement.

- **Submersible pumps**: In most submersible pump designs, the pump bowl and impeller are not designed to be replaced separately. The pump bowl is typically an integral part of the pump housing, and the impeller is directly attached to the motor shaft within the pump assembly. These components are often sealed and integrated as a single unit to ensure proper operation and prevent water leakage into the motor. If the pump bowl or impeller in a submersible pump is worn out, it is generally recommended to replace the entire pump assembly rather than attempting to replace individual components. This ensures that the new pump assembly is properly sealed, compatible, and maintains the performance characteristics of the original design. Replacing the entire pump assembly usually involves installing a new pump assembly that includes the pump bowl, impeller, and motor. Replacing the entire pump assembly would be a NR measure and not appropriate under BRO. This pump category seems to be the only category where BRO would be appropriate when "both" the pump impeller and bowl need to be replaced. In other words, the bare pump replacement (replacing both the bowl and impeller but keeping the existing shafts, columns, discharge assembly, driver, and other original equipment) can be categorized as BRO for submersible pumps.
- **Magnetic drive pumps**: Magnetic drive pumps use a magnetic coupling to transmit power from the motor to the impeller, eliminating the need for a direct mechanical shaft connection. In these pumps, the pump bowl and impeller are typically designed as a single unit to maintain the integrity of the magnetic drive system, and they cannot be separated easily. In magnetic drive pumps, the pump assembly and motor are typically designed as an integrated unit. Separating the pump assembly from the motor without damaging the magnetic coupling or compromising the hermetic seal is often not feasible or recommended. If the pump assembly, including the pump bowl and impeller, needs to be replaced in a magnetic drive pump, it is generally necessary to replace the entire unit, which includes the motor to ensure compatibility, proper alignment, and maintains the hermetic seal necessary for the pump's operation. This would be a replacement measure. Replacing the entire unit would be an NR measure and not appropriate under BRO.
- **Vertical turbine pumps**: In most cases, it is possible to replace the pump assembly, including the bowl and impeller, separately from the motor in vertical turbine pumps. The impeller and casing can often be replaced separately as well. The pump stages are typically designed to be individually accessible, allowing for independent replacement of the impeller and casing in each stage. Replacing either pump bowl or impeller would be a valid BRO measure. For any valid overhaul activity, the program is required to provide evidence to show that service level requirements are met by the existing pump. If the motor is also replaced, then the measure becomes a NR measure.

<u>ii. Machine work (e.g., re-facing, pit and hole filling, replacing wear rings) to return either or both pump's bowl and impeller to original condition, or</u>

This is a valid BRO measure and the original definition of pump overhaul.

<u>iii. Trimming of impellers, or</u>

This is usually done to meet a new service requirement (e.g., new flow, new pressure). The program needs to clearly explain (with evidence) why and how the service requirement changed and provide evidence to support it.

iv. Addition or removal of a stage, and/or

This is usually done to meet a new service requirement (e.g., new flow, new pressure). The program needs to clearly explain (with evidence) why and how the service requirement changed and provide evidence to support it.

v. Complete pump replacement in accordance with CPUC Early Opinion Response dated 10/03/2019, complete pump replacement is allowed to be treated as a BRO measure with a default EUL of 3 years. The pump replacement must meet the existing pump's service level requirements. This includes replacement of the entire Pump as defined by eCFR :: 10 CFR 431.462 – Definition of "Pump", which includes the bare pump (pump bowl and volute assembly and impeller) and mechanical equipment (tube and shaft), driver (motor) and controls (VFD or variable clutch drive).

This is not correct. Complete pump replacement is not allowed under BRO and should be categorized as an NR measure. In this case incremental savings should be estimated based on the standard practice baseline. The 2019 EO only allowed replacements when a pump is in a shop, and it's determined that replacement is necessary and more efficient replacement options that meet the customer's level of service are not available. This was expanded to generally allow pump replacements by SCE. Going forward, pump replacements should be categorized as Normal Replacements and savings should be calculated based on standard practice.

Please note that for all pump overhaul measures, the existing pump should be able to provide the level of service required by the customer prior and after the overhaul.

Calculations:

It is not appropriate to estimate savings based on the ratio of pre- and post- OPE or Acre ft as neither of these approaches calculate savings based on an equivalent level of service. Energy savings analysis should be based on a fixed pump productivity or water delivery rate over the baseline period. Pump productivity can be calculated as the pre-overhaul pump runtime multiplied by the pre-overhaul pump flow (gpm). In this case, post-overhaul energy use equals the post-overhaul pump power input (measured motor kW) multiplied by the ratio of the pre-to-post measured pump flow multiplied the pre-overhaul pump runtime. The energy impacts are then calculated as the pre-overhaul pump energy consumption (baseline consumption) minus the calculated post-overhaul pump energy consumption. This direction was provided to all PAs in a statewide disposition issued for a PG&E project and communicated to all PAs. Please refer to the "SW Pump Repair First EAR.pdf" located on CMPA (https://deeresources.info/cmpa/tree?filter=file&searchInput=SW+pump+repair). We were not able to find any new CPUC issued document that changed this direction. Any deviation from this approach should show how the new approach would take care of service level equivalency. This is needed because the flow provided by the pump can increase after the overhaul, leading to an anticipated reduction in pump runtime. Given no productivity changes are explicitly noted in this EO for the scope of pump overhaul projects, the PA should estimate savings based on the pre- pump annual water delivery rate.

PA Response to CPUC Response

1. Concerning the eligibility of pump overhauls based on specific pump types it was mentioned that "The feasibility of replacing components such as the pump bowl (or volute or casing), impeller, and motor separately depends on the specific type and design of the pump."

Although we agree the pump type and design is a good indication of what scope of work is probable due to the typical integration of components and scope of work incurred after the pump is pulled. However, typical scenarios shouldn't be used to rule out all scenarios. We would like to first clarify that you can choose to replace only the volute assembly of an end suction close coupled pump. Also, some submersible pumps are integrated units but not all of them. We have seen integrated submersible pumps in the context of lift station operations. For example, there have been cases in which submersible well pumps have undergone bowl replacements without a motor replacement. This scenario might not be the typical scenario but would still be eligible as BRO Pump Overhaul. Due to this variation in actual scope, it is proposed to keep eligibility based on activity instead of technology type.

CPUC Response (7/15/2023)

We offered these general guidelines based on pump types to clarify that eligibility requirements based on the specific scope of the overhaul. The final determination should be based on the project's actual scope and whether the existing pump meets the service level requirements as expected by the customer.

2. Additionally, it seems that "Addition or removal of a stage" is grouped up with pump replacement projects above.

Please clarify why addition or removal of a stage was combined with full pump replacement scope as the addition or removal of a stage may happen without the pump being replaced and is a cost-effective way to correct the pump's curve to changes in system curve. Example common changes in system curves is change in TDH requirement per water table changes, or system structure change. As shown in the figures below, most of the original pump remains following the addition or removal of a pump stage.

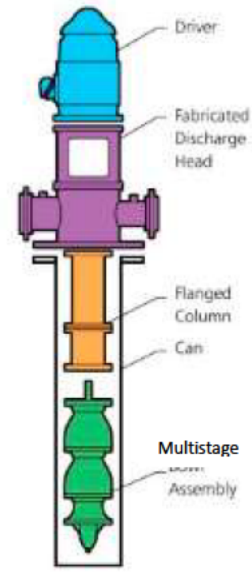

Figure 1: Multistage Bowl Assembly of a Vertical Turbine Pump (Source: [Vertical Turbine Pumps - Goulds Pumps](#)**)**

As shown in Figure 1, the Driver or motor and the remaining stages of the Bowl Assembly remain following the addition or removal of a pump stage for a Vertical Turbine pump.

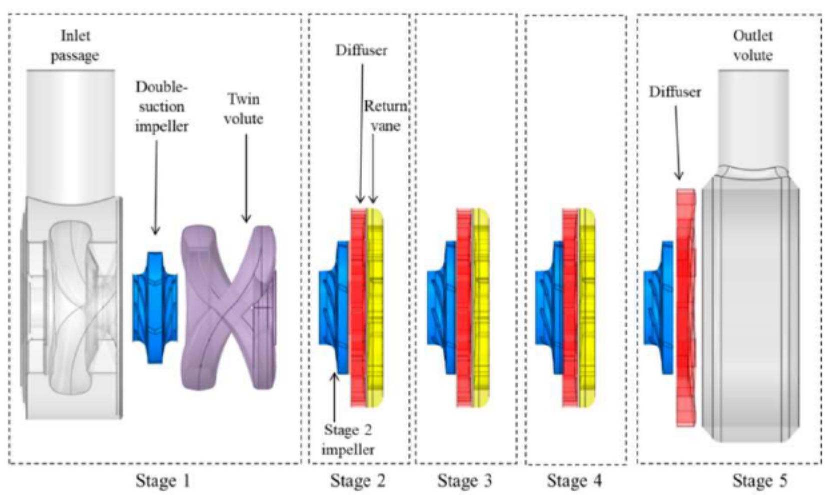

Figure 2: Expanded View of a Multistage Centrifugal Pump (Source: [Effect of an Inducer-Type Guide Vane on Hydraulic Losses at the Inter-Stage Flow Passage of a Multistage Centrifugal Pump](#)**)**

Figure 2 shows the pump inlet and outlet volute, other pump stage(s) and impeller(s) remain following the addition or removal of a pump stage for a multistage centrifugal pump. Given these clarifications, please confirm the additional or removal of a stage is eligible BRO pump overhaul scope.

CPUC Response (7/15/2023)

We have fixed the inadvertent combination of these two items. We now provide separate responses for pump replacement and the removal of a stage.

3. In the response provided it was mentioned that "Complete pump replacement is not allowed under BRO and should be categorized as a Normal Replacement measure"

Can you please provide clarification on why a full pump replacement is not allowed under BRO? Please note we referenced the definition of BRO under E-4818 which clearly states that all activities and installations that restore nominal efficiency should be treated as BRO. If complete replacement restores equipment's nominal efficiency, it should be treated as BRO per E-4818.

*"All activities and **installations that restore equipment performance to its nominal efficiency** (i.e., rated, intended, or original efficiency) but do not enhance the nominal efficiency must classified as BRO."*

Additionally, in cases where the nominal efficiency is enhanced, please clarify why a portion of the scope for full pump replacement is not eligible as a BRO pump overhaul. The component energy savings associated with overhauling the pump, bringing the pump back to nominal efficiency, can be calculated and separated from the Normal Replacement savings (savings above standard practice). This route for claiming BRO savings has clearly been defined in resolution E-4818 **-** *In cases where these savings are a component of the savings captured through equipment replacement, separate claims should be made for the equipment replacement savings and savings that arise from updating maintenance and operational factors." (pg. 28)* The reason for allowing separate claims for the portion of the work that qualifies for an overhaul is to not hold the customer under any unnecessary scope restraints. Especially for pump overhauls, it's important to draw the boundary conditions of what scope is eligible for pump overhauls and not disallow projects where customer had to conduct additional scope such as work that does not increase the efficiency of the pump. The incentives and program technical influence has worked to influence the customer to pull the pump and assess it for an overhaul. Once the pulled pump is assessed additional scope might be recommended by pump contractors and customers should not be punished unfairly for going above and beyond the measure recommendation. These are project scopes that may or may not be identifiable or disclosed to any implementor as the boundary condition for the measure of interest is the pump overhaul itself. The customer's hands should not be tied from doing additional work per their interest or need, or there will be a significant reduction in participation. Furthermore, the savings are still achieved and conservatively held to only the overhaul portion of the work.

CPUC Response (7/15/2023)

The E-4818 language quoted here appears to be taken out of context. The BRO activities are allowed for claiming savings associated with a degraded efficiency. However, when a pump is completely replaced, the project should be categorized as a replacement project, and the savings calculations should be based on the nominal efficiency of the existing pump, as mandated by E-4818:

"THEREFORE IT IS ORDERED THAT:

1. For deemed and calculated savings determinations, we direct the Program Administrators to ensure that the nominal efficiency used as an existing conditions baseline will reflect the efficiency rating, designed efficiency,

or original efficiency of well-maintained and properly configured equipment for all measures, except those classified as behavioral, retrocommissioning and operational (BRO)."

Based on SCE's interpretation, a like-to-like replacement of equipment would qualify as a BRO measure with a three-year EUL. The commission has not authorized such a like-for-like replacement.

4. In the response provided, the existing calculation methodology for pump overhauls was rejected and a new calculation methodology and equation was proposed. "It is not appropriate to estimate savings based on the ratio of pre- and post- OPE or Acre ft as neither of these approaches calculate savings based on an equivalent level of service"

Please note that Acre ft is the volume of water produced by the pump and used in the industry commonly as the productivity level of the pump to indicate its level of service. The following equation below was provided as a suggestion but seems to be based on instantaneous values that do not incorporate the annual variations in pumping that is typically seen.

Savings= [kW_pre – kW_post x (gpm_pre/gpm_post)] x HOU_pre

Please clarify the basis/reference for the new calculation methodology provided above. An updated calculation methodology was not expected with this EO as we are following past CPUC vetted calculation methodology that has been reviewed and approved many times. As there is no change in scope or application of pump overhauls, there should not be any major change in calculation methodology. Below is further justification of why the existing kWh/Acre Ft. methodology is appropriate for pump overhauls.

- It's important to first note that the terminology for the energy intensity (kWh/Acre ft.) metric and Overall Plant Efficiency (OPE) are commonly presented in pump test reports and are commonly accepted in this industry. Presenting new energy savings equations with metrics that vary from these commonly accepted terms can confuse the customer segment and lose trust.
- The service level requirement for a pump is the volume of water moved in a given service period. The instantaneous volume of water produced by a pump (CFS or GPM) can vary significantly as it is dependent on many factors, such as efficiency of the pump that degrades over time, varying water tables/pumping water levels or suction pressure depending on pump type and design which can change under environmental conditions or changes to the customer's system, discharge pressure which can vary depending on connected reservoir levels or changes to customer's system, and customer demand requirements. An example of varying customer demand requirements is WWTP influent pumping systems that follow typical diurnal flow rates. In these systems a VFD might be used to vary the speed of the pump to match influent flow demands at different hours of the day. The volume of water produced can also vary annually based on drought and wet year conditions. To account for this variation, the total volume of water produced by a pump is normalized using 3-5 years of data in the existing calculation methodology. We agree that energy savings should be based on the productivity of the pump, but the kWh/Acre Ft. methodology encompasses the productivity as its normalized per volume of water produced per year. The instantaneous GPM productivity can vary significantly based on water levels, demand at time of pump test, and control methodology such as VFDs, control valves or throttling valves. Using an equation that is dependent on this level of variation can lead to highly volatile results, in some cases very high savings and other cases very low savings. The provided kWh/Acre Ft. calculation methodology provides a way to properly account for these variations and should not be revised.

- Please note the same variations described above can have major impacts on the instantaneous kW measured. At times the post-overhaul tested kW can be much lower than pre-overhaul tested kW due to changes in water level, TDH, or other system characteristics that fluctuate normally. At other times the post-overhaul tested kW can be higher than pre-overhaul tested kW even though the OPE and kWh/Acre ft. has improved. Simply taking the subtraction of kW as shown in provided new calculation methodology equation can therefore lead to overestimation of savings in some scenarios and even negative savings when efficiency has been shown to have improved.
- Please see below for example pre and post tests that show incorrect results when new calculation methodology is applied, in comparison with existing calculation methodology on review and approved existing projects:

Example 1 – 200 HP Single Speed Turbine Booster (on/off controlled by reservoir level) underwent Refurbishment/Machining of Bowl Assembly

Pre kW	Post kW	Pre GPM	Post GPM	HOU_pre	Pre kWh/Acre ft.	Post kWh/Acre ft.	Annual Acre ft.	Existing Methodology Savings (kWh/yr)	New Methodology Savings (kWh/Yr)
152.00	151.90	2,147	2,140	5,446	402	385	3,101	52,717	546

CPUC Response (7/15/2023)

The methodology employed by SCE to review and/or calculate these values is not clear. Based on our calculations using SCE's existing methodology (i.e., Annual Acre ft. x [pre kWh/A-Ft - post kWh/A-Ft]), the resulting savings were determined to be negative.

Example 2 – 125 HP Single Speed Turbine Well Pump underwent replacement of Pump Bowl with Impeller Trim

Pre kW	Post kW	Pre GPM	Post GPM	HOU_pre	Pre kWh/Acre ft.	Post kWh/Acre ft.	Annual Acre ft.	Existing Methodology Savings (kWh/yr)	New Methodology Savings (kWh/Yr)
95.4	80.3	1,014	908	8,630	511	480	1,368	42,408	145,526

CPUC Response (7/15/2023)

We are unable to replicate the numbers provided, and there is uncertainty regarding the methodology employed by SCE to review and calculate these values. According to our own calculations using SCE's existing methodology, the savings were determined to be negative. Furthermore, it is unusual for the flow to decrease after an overhaul since such activities typically result in increased flow.

In cases where the flow has significantly increased or decreased, it is essential for the PA to clearly explain any changes to the service requirements. It should be demonstrated that the program is more likely than not responsible for the service change, rather than the customer already having established the new service requirement.

Example 3 – 500 HP Single Speed Turbine Well Pump underwent refurbishment of existing pump assembly

Pre kW	Post kW	Pre GPM	Post GPM	HOU_pre	Pre kWh/Acre ft.	Post kWh/Acre ft.	Annual Acre ft.	Existing Methodology Savings (kWh/yr)	New Methodology Savings (kWh/Yr)
377.0	380.0	1,420	2,690	3,140	818	767	1,457	74,307	-4,972

CPUC Response (7/15/2023)

Here again we calculated savings using SCE's existing methodology to be 399,884 kWh. We also have the same concern about the service level change.

In this example flow has increased significantly after the overhaul which can be an indication of this project being done to meet a new service level.

Example 4 – 350 HP Single Speed Centrifugal Booster Pump underwent rebuild of pump bowl assembly

Pre kW	Post kW	Pre GPM	Post GPM	HOU_pre	Pre kWh/Acre ft.	Post kWh/Acre ft.	Annual Acre ft.	Existing Methodology Savings (kWh/yr)	New Methodology Savings (kWh/Yr)
250.5	254.4	5,153	6,479	4,200	264	213	4,722	240,822	-13,028

CPUC Response (7/15/2023)

Here again we calculated savings using SCE's existing methodology to be 154,815 kWh. We also have the same concern about the service level change.

As shown above, the new calculation methodology approach leads to significant volatility in results and errors. As such, please accept and approve the existing calculation methodology that is accurately being used in industry. Additionally, the calculation methodology for separating savings for normal replacement component is added below.

CPUC Response (7/15/2023)

Based on the example mentioned above, we cannot confirm whether the calculations have been performed accurately. It is important to highlight that SCE is obligated to review the function and control of the pump to establish the customer service level and adjust the savings calculation approach accordingly.

It should be noted that the method of calculating savings needs to account for the specific characteristics of the pump and its intended operation. The service level requirement should be established by the PA for each case, taking into consideration factors such as whether the pump is controlled to move a fixed amount of water, such as in the case of well pumps, or if it operates continuously, such as in the case of a wastewater treatment plant pump. Normalizing the savings based on the equivalent level of service is what is needed in all of these cases. Any change to service level change should be documented by the program.

The use of a pre-post OPE approach, whether directly or as embedded values in the kWh/Acre-ft calculation, is deemed invalid as it fails to adjust savings for the equivalent level of service. In addition to this, we have encountered many cases in the past where the post-pump test results were based on bench tests rather than actual in situ operations.

Moreover, CPUC has required actual measurements to claim peak demand savings for pump overhaul projects, but this direction does not mean that SCE is allowed to ignore any increase in kW.

Pump Overhaul Measure Calculation Methodology:

Energy Savings (kWh)

Energy Savings (kWh) = (Annual Acre Ft. DemandBase * (kWh/Acre Ft. Base – kWh/Acre Ft. Post)) - Motor Replacement Energy Savings (kWh) Where,

Annual Acre Ft. DemandBase = Annual Acre Ft. pumped as derived through pump test and/or customer SCADA data

kWh/Acre Ft. Base = Derived through baseline pump test or available SCADA data

kWh/Acre Ft. Post = Derived through post pump test or available SCADA data

Normalization must be performed if water demand or total dynamic head (TDH) is more than +/- 10% different in the post-install when compared to the pre-install conditions.

If a motor replacement occurs, then the below equations will be used to separate the savings due to a motor replacement.

Motor Replacement Energy Savings (kWh) = Proposed Energy Usage (kWh) – Baseline Motor Energy Usage (kWh_M)

Installed Motor Energy Usage (kWh) = (Annual Acre Ft. DemandBase * (kWh/Acre Ft. Post))

Baseline Motor Energy Usage (kWh_M) = Installed Energy Usage (kWh) * η_{base} / $\eta_{stalled}$

η_{base} = the existing motor's nominal efficiency per its nameplate or specification sheet

$\eta_{stalled}$ = installed motor's nameplate or specification sheet efficiency

PA Response to CPUC Response 2

After further clarification following our meetings with CPR on 7/6/2023 and 8/3/2023, and the CPUC responses provided on 7/20/2023, PA would like to provide the additional response below for CPUC review.

1. Concerning the eligibility of pump overhauls in cases where there is or will be a change in service level requirement, in which the scope to include addition/removal of stage or trimming of impellers would likely be recommended to bring the existing pump's operation closer to its BEP, PA would like to clarify that this scope will only be found eligible if the existing pump could of met the customer's change in service level. This check in service level requirement will be done using the existing pumps curve or operational data showing that it could have operated at post pressure and flow requirements. Please note, this agrees with CPUC response provided above: Please note that for all pump overhaul measures, the existing pump should be able to provide the level of service required by the customer prior and after the overhaul.
2. After receiving clarification that the calculation methodology provided by CPUC is also considering actual average values over a period of time and not only pump test values, we would like to retract our previous examples provided and consider the below clarification that both methodologies can be the same if derived from the same pumping values for flow, head, operating hours, and power draw. Please note, the differences in kWh/AF calculations noted above in previous examples provided are due to the normalization of TDH and the lack of using actual average kW and GPM values instead of just the pump test values. The comparison provided was showing pump test values and the actual average kWh/AF based on SCADA data that accounts for any normalization in TDH that occurred.

Energy Savings (kWh) = (Annual Acre Ft. DemandBase x (kWh/Acre Ft. Base – kWh/Acre Ft. Post))

Please note that each value in the above equation can simplify to be the below derivatives:

Annual Acre Ft. DemandBase = HOU_{pre} x GPM_{pre} x B

B = Constants for conversion of AF/yr to GPM = 60 min/hour *0.00000306889 Af/gallon

kWh/Acre Ft. Base = kWh_{pre} / Annual Acre Ft. DemandBase

kWh/Acre Ft. Post = kWh_{post} / Annual Acre Ft. DemandPost

Annual Acre Ft. DemandPost = HOU_{post} x GPM_{post} x B

kWh_{pre} = kW_{pre} x HOU_{pre}

kWh_{post} = kW_{post} x HOU_{post}

Please note that each value above is to be determined by taking averages of SCADA Data, Water meters, or utility data over a period. In some cases, such as multiple pump single meter scenarios, pump tests may be used in combination with SCADA Data, Water meters, or utility data to derive individual pump metrics.

Plugging in the derived values back into the Energy Savings equation we get:

Energy Savings (kWh) = (Annual Acre Ft. DemandBase x (kWh/Acre Ft. Base – kWh/Acre Ft. Post))

$= (HOU_{pre} \times GPM_{pre} \times B \times [(kW_{pre} \times HOU_{pre} / (HOU_{pre} \times GPM_{pre} \times B)) – (kW_{post} \times HOU_{post} / (HOU_{post} \times GPM_{post} \times B))]$

This further simplifies as follows:

$= (HOU_{pre} \times GPM_{pre} \times B \times [(kW_{pre} \times \cancel{HOU_{pre}} \times B / (\cancel{HOU_{pre}} \times GPM_{pre} \times B)) – (kW_{post} \times \cancel{HOU_{post}} / (\cancel{HOU_{post}} \times GPM_{post} \times B))]$

$= (HOU_{pre} \times GPM_{pre} \times B \times [(kW_{pre} / (GPM_{pre} \times B)) – (kW_{post} / (GPM_{post} \times B))]$

$= (HOU_{pre} \times GPM_{pre} \times kW_{pre} \times B / (GPM_{pre} \times B)) – (HOU_{pre} \times GPM_{pre} \times kW_{post} \times B / (GPM_{post} \times B))$

$= (HOU_{pre} \times \cancel{GPM_{pre}} \times kW_{pre} \times \cancel{B} / (\cancel{GPM_{pre}} \times \cancel{B})) – (HOU_{pre} \times GPM_{pre} \times kW_{post} \times \cancel{B} / (GPM_{post} \times \cancel{B}))$

$= (HOU_{pre} \times kW_{pre}) – (HOU_{pre} \times GPM_{pre} \times kW_{post} / GPM_{post})$

$= (kW_{pre} – kW_{post} \times GPM_{pre} / GPM_{post}) \times HOU_{pre}$

As demonstrated above the two equations simplify to be the same equation:

Savings= [kW_pre – kW_post x (gpm_pre/gpm_post)] x HOU_pre

However, we would like to further clarify that the GPM ratio should be clearly shown to be a correction to the annual operating hours and not misinterpreted as a normalization of the kW. To do so, the equation further breaks down as shown below:

Energy Savings (kWh) $= (kW_{pre} – kW_{post} \times GPM_{pre} / GPM_{post}) \times HOU_{pre}$

Energy Savings (kWh) $= (kW_{pre} \times HOU_{pre}) – kW_{post} \times (HOU_{pre} \times GPM_{pre} / GPM_{post})$

Please note, that $HOU_{pre} \times GPM_{pre} / GPM_{post} = HOU_{Post}$

This also simplifies to the general energy savings equation that oversees all Energy Efficiency projects:

Energy Savings (kWh) $= (kW_{pre} \times HOU_{pre}) – (kW_{post} \times HOU_{Post})$

Energy Savings (kWh) $= (kWh_{pre}) – (kWh_{Post})$

Please see example confidential project package provided with calculation worksheet showing that the two methodologies for determining energy savings can be the same.

These equations assume that the TDH remains the same between pre and post conditions. If the TDH between the pre and post conditions vary by more than +/- 10%, which can generally happen due to changes in water levels, we would normalize the baseline energy consumption to take account of the TDH differences. In this scenario, energy savings would be:

Energy Savings (kWh) $= (kWh_{pre,adj}) – (kWh_{Post})$

$kWh_{pre,adj}$ is the adjusted baseline kWh which takes into account significant TDH differences and the change in pumping efficiency based on the pump curve that would occur if the baseline degraded pump operated at the post TDH. The TDH can be normalized by the equations as follow:

Please note, that the Overall Plant Efficiency of a pumping system is defined as:

$$OPE = \frac{GPM\ x\ TDH}{kW\ x\ C}$$

Where, OPE = Overall Plant Efficiency
GPM = Pumps flow rate
TDH = Pumps total developed head
kW = Pumps motor input kW
C= Conversion factor (3960/0.746)

To convert this equation into terms of kW and kW we get the following relationship:

$$kW\ = \frac{GPM\ x\ TDH}{OPE\ x\ C}$$

$$kW\ x\ HOU\ = \frac{GPM\ x\ TDH\ x\ HOU}{OPE\ x\ C}$$

Where, HOU = Hours of use

This further simplifies to:

$$kWh = \frac{AF\ x\ TDH}{OPE\ x\ C\ x\ C_1\ x\ C_2}$$

Where,

C_1 = Conversion constant, 60 minutes / 1 hour

C_2 = Conversion constant, 3.06888 x 10-6 acre feet / 1 gallon

$$kWh/AF = \frac{TDH}{OPE\ x\ C\ x\ C_1\ x\ C_2}$$

$$(kWh/AF)_i = \frac{TDH_i}{OPE_i\ x\ C\ x\ C_1\ x\ C_2}$$

$$(kWh/AF)_j = \frac{TDH_j}{OPE_j\ x\ C\ x\ C_1\ x\ C_2}$$

Where, i and j indicate two different operational points.

The relationship between the pump efficiency at two different operating points can then be defined as:

$$\frac{\left(\frac{kWh}{AF}\right)_j}{(kWh/AF)_i} = \frac{\frac{TDH_j}{OPE_j}}{\frac{TDH_i}{OPE_i}}$$

$$\left(\frac{kWh}{AF}\right)_j = \left(\frac{kWh}{AF}\right)_i x \frac{TDH_j}{TDH_i} \; x \; \frac{OPE_i}{OPE_j}$$

Therefore, to adjust the pre kWh/AF to post TDH values, we can follow the below methodology:

$$\left(\frac{kWh}{AF}\right)_{pre,adj} = \frac{\left(\frac{kWh}{AF}\right)_{pre}}{TDH_{pre}} \times TDH_{pre,adj} \text{ x } \frac{OPE_{pre}}{OPE_{pre,adj}}$$

Where, $TDH_{pre,adj} = TDH_{Post}$

$OPE_{pre,adj}$ = OPE of baseline pump at $TDH_{pre,adj}$

Please note, $TDH_{post} = TDH_{pre,adj}$ and the $OPE_{pre,adj}$ is the pump's pre OPE if operating at adjusted head. Typically for deep well pumps which have steeper curves, there is not a significant effect on pump efficiency with TDH and so the OPE adjustment can have insignificant changes.

$$\left(\frac{kWh}{AF}\right)_{post} = \frac{kW_{post} \times HOU_{post}}{AF_{post}}$$

$$(kWh)_{pre,adj} = \left(\frac{kWh}{AF}\right)_{pre,adj} \times GPM_{pre} \times C_1 \times C_2 \times HOU_{pre}$$

$$(kWh)_{post} = \left(\frac{kWh}{AF}\right)_{post} \times GPM_{post} \times C_1 \times C_2 \times HOU_{post}$$

Which then concludes to:

Energy Savings (kWh) = ($kWh_{pre,adj}$) – (kWh_{Post})

In regard to comments provided to example projects calculations provided above in first PA Response to CPUC comments, please see below for clarification:

In response to example one, CPUC mentioned that "There seems to be errors in how these values are calculated. The pre- kWh/A-ft should be 384.5 =152/ (2147 x 60) x 325851. This project using SCE's own approach would result in -3,900 kWh of savings"

During the review of the project data used in the example, we found a transcribing error with the reported Pre GPM (corrected from 2147 to 2050). Also, it was found that the 2016 methodology was incorrectly applied due to the misplacement of parentheses in equation. The values has been corrected as shown below:

Example 1 – 200 HP Single Speed Turbine Booster (on/off controlled by reservoir level) underwent Refurbishment/Machining of Bowl Assembly

Pre kW	Post kW	Pre GPM	Post GPM	HOU_Pre	HOU_post	Pre kWh/Acre ft.	Post kWh/Acre ft.	Annual Acre ft.	2019 Methodology Savings (kWh/yr)	2016 Methodology Savings (kWh/Yr)
152	151.9	2,050	2,140	8,215	7,870	402	385	3,101	52,717	53,302

We have also provided the HOU_post for clarification of how the change in GPM is accounted for in the fixed Annual Acre ft. approach. Mathematically, the two approaches are the same but resulting in slightly different savings due to differences in rounding approximations.

In response to example two, CPUC mentioned that "Both pre- and post- kWh/A-ft values are incorrect. These values should be 814.1 and 909.1 and savings using SCE existing approach would be -130,011 kWh"

We were unable to match these values calculated by CPUC. Using the same methodology used in example 1, we found that the provided kWh/AF and savings values to be correct. Please see below for example with corrected 2016 calculation methodology and clarification of run hours:

Pre kW	Post kW	Pre GPM	Post GPM	HOU_Pre	Pre kWh/Acre ft.	Post kWh/Acre ft.	Annual Acre ft.	2019 Methodology Savings (kWh/yr)	2016 Methodology Savings (kWh/Yr)
100.1	79.1	1,013.9	860.9	7,326	536.3	498.7	1,446.5	54,384.5	54,384.5

Similar changes were made in examples 3 and 4 below. It was found although there are small changes due to differences in rounding approximations, that no methodology was more conservative than the other. In some cases the savings are about 1% higher and in other cases about 1% lower, which is attributable to rounding differences.

Example 3 – 500 HP Single Speed Turbine Well Pump underwent refurbishment of existing pump assembly

Pre kW	Post kW	Pre GPM*	Post GPM	HOU_Pre	HOU_post	Pre kWh/Acre ft.	Post kWh/Acre ft.	Annual Acre ft.	2019 Methodology Savings (kWh/yr)	2016 Methodology Savings (kWh/Yr)
377	380	2,502	2,690	3,162	2,942	818	767	1,457	74,307	74,489

*Please note a similar transcribing error was found with this example and corrected here.

Example 4 – 350 HP Single Speed Centrifugal Booster Pump underwent rebuild of pump bowl assembly

Pre kW	Post kW	Pre GPM	Post GPM	HOU_Pre	HOU_post	Pre kWh/Acre ft.	Post kWh/Acre ft.	Annual Acre ft.	2019 Methodology Savings (kWh/yr)	2016 Methodology Savings (kWh/Yr)
250.5	254.4	5,153	6,479	4,976	3,958	264	213	4,722	240,822	239,673

Please note, the above examples were provided as quick pump test value comparisons, and do not take into account actual M&V, TDH normalization, AF normalization, and resulting true savings calculated for these projects. As such we are providing 2 real examples found in "CONFIDENTIAL SCE-033 Project Examples.zip" folder, including example 2 above as a comparison, and a past ED reviewed and approved example. The two provided examples provide insight on how TDH, a common variable, is typically driven by common changes to the system. Below are common system changes that can impact the TDH significantly requiring the savings to be normalized to a common TDH between the pre and post conditions:

1. Changes to Well depths between dry and wet seasons will have proportional impact on pumping water level and TDH
2. Similarly, changes to Well depths can occur due to excessive pumping from an aquifer or recharge of that aquifer
3. Changes to reservoir operating levels will typically change the discharge pressure of the pump and its resulting TDH
4. Changes in operating pressure of connected process system, such as RO filtration at a water treatment plant served by a booster pump. This can happen when the pump test is done when the membranes are dirty versus clean.

Below are changes to systems that are less common and would typically require additional analysis to determine if the baseline existing equipment could still meet service levels:

1. Changes to connected pipe size or length will typically change the discharge pressure of the pump and its resulting TDH
2. Changes to pumps control valve or addition of valves can change the discharge and its resulting TDH
3. Additions of well head filtration or disinfection systems

As noted in the below equation, pump's power input is proportional to the TDH:

$$kW = \frac{GPM\ x\ TDH}{OPE\ x\ C}$$

Where, OPE = Overall Plant Efficiency
GPM = Pump's flow rate
TDH = Pump's total developed head

kW = Pump's motor input kW
C= Conversion factor (3960/0.746)

As such, since both pre and post pump tests, and/or pre and post M&V data, can be data collected during different operating periods subject to significantly (> +/- 10%) different TDH values, the normal ongoing TDH values must be determined and utilized to normalize the pre or post energy consumption so that savings are representative of actual lifecycle savings.

For the first live example provided, it was found that based on most recent Well Level Data (4 weeks of weekly measurements) provided in the post-overhaul case, that the well levels have dropped and resulting TDH has increased. The data was more recent and more comprehensive than baseline pre-pump test, and therefore more representative of the pump's on-going operations.

Similarly, for the 2nd live example provided, it was found that based on post overhaul data (2 Weeks of 5 minute interval data) the system's discharge pressure has increased significantly in comparison to its pre-pump test. The data was more recent and more comprehensive than baseline pre-pump test, and therefore more representative of the pump's on-going operations. In this example, since the post-test was also not corresponding to the same average system pressure, the post energy consumption was also normalized to the same TDH.

CPUC Response (11/7/2023)

Considering that both equations, as proposed by the statewide disposition and SCE's proposal, yield similar results when utilizing appropriate M&V and SCADA data, we recommend adopting the equation from the statewide disposition to prevent any inadvertent errors (refer to our comments provided throughout this document). Furthermore, savings can be normalized for changes in TDH whenever TDH undergoes fluctuations.

We did not assess the figures presented in the tables above, as we have already provided our comments on them. We reviewed the live calculation in Example 1, and we have provided feedback throughout this document. The future project calculations will undergo reviews during future CPR and ex post evaluations.

Third Party Implementer/PA EO Question 2.

The SW WISE program is seeking EO from CPUC staff on the implementation of pump overhaul measures within the program. More specifically, PA would like to request confirmation on our understanding of what scope of work is eligible for pump overhaul within the SW WISE program.

PA Opinion/Proposed Response to EO Question 2. (must be filled in)

The SW WISE program believes that the following pump overhaul scope of work is eligible for incentives:

1) Replacement of either or both pump bowl/volute and impeller, or
2) Machine work (e.g., re-facing, pit and hole filling, replacing wear rings) to return either or both pump bowl and impeller to original condition, or
3) Trimming of impellers, or
4) Addition or removal of a stage, and/or
5) Complete pump replacements which include replacement of the entire Pump as defined by eCFR :: 10 CFR 431.462 – Definition of "Pump", which includes the bare pump (pump bowl and volute assembly and impeller) and mechanical equipment (tube and shaft), driver (motor) and controls (VFD or variable clutch drive).

Resolution E-4818, under Section 1.3.1.2 "Existing Conditions" and Section 1.3.6.4 "Behavioral, Retrocommissioning and Operational (BRO)" state the following:

*"All activities and **installations that restore equipment performance to its nominal efficiency** (i.e., rated, intended, or original efficiency) but do not enhance the nominal efficiency must classified as BRO." (pg. 13)*

And

*"For deemed and calculated savings determination, savings from correcting deferred maintenance, **performance restoration** and operational characteristics are considered within this category only. In cases where these savings are a component of the savings captured through equipment replacement, separate claims should be made for the equipment replacement savings and savings that arise from updating maintenance and operational factors." (pg. 28)*

Based on this, it is our strong opinion the complete pump replacement, including the bare pump and mechanical equipment, driver, and controls, should be eligible for energy savings and incentives through the SW WISE program under BRO MAT when complete pump replacement results in performance restoration of the pumping unit. It is our understanding from the above excerpt (in blue) from E-4818 that savings claimed from equipment replacements that occur as a part of a BRO measure has to be above the Standard Practice Baseline (SPB). As such, we would like to propose that all the savings resulting from the complete replacement of a pump submitted through the custom pump overhaul measure (BRO) are eligible for energy savings.

SCE agrees with [redacted] understanding of the scope of work for pump overhaul and it aligns with SCE's understanding at the time of EO-01 was approved.
(If Needed) CPUC Staff Clarifying Question(s) to PA Please see Pump Overhaul Scope section for our response to this question.
(If Needed) PA Response to CPUC Clarifying Question(s)
CPUC Response

Third Party Implementer/PA EO Question 3.

Since the launch of the SW WISE program, pumping operational data was received from customers and used to identify pump overhaul opportunities. We encountered pumps previously overhauled and incentivized in an energy efficiency program funded by PPP surcharge, operating past the effective useful life (EUL) of the previous project's overhaul measure, and identified as a new overhaul opportunity. Additionally, there are customers who have been influenced to conduct overhauls in the past, but don't have the technical ability nor available budget to continue identifying and developing the scope for additional overhauls without the program's support.

A couple of factors account for these past participants and repeat pump overhaul opportunities. One factor includes changing water table levels for well pumps. Although the existing pumps are still capable of meeting the service level requirements (GPM or AcreFt production), they are now operating inefficiently due to reduced water levels (e.g., water level dropping 100 ft for example). Other examples include pumps exposed to more corrosive environments, higher run hours, and whose efficiencies have degraded. The customer segment is only focused on water quality and delivery, or wastewater treatment, and therefore doesn't have the staffing, the technical expertise, nor the available budget to identify these energy efficiency opportunities. These are all barriers that the program is designed to overcome for the customer segment.

We would like an EO from CPUC staff to confirm the program may service past participants of programs funded by the PPP surcharge and offer SW WISE incentives for pump overhauls, if program influence can be proven per resolution E-5115 requirements. This includes previously overhauled and incentivized pumps, operating past the measure's EUL, and the current pump operation is compliant with the pump overhaul guidance for SW WISE.

PA Opinion/Proposed Response to EO Question 4. (must be filled in)

Based on [redacted] experience in the water, wastewater and irrigation industries, typically there are multiple pumps identified with pump overhaul opportunity across a single customer's water/wastewater facilities after an initial assessment. Without the active guidance, influence, and encouragement provided by energy efficiency programs, such as SW WISE, customers would not perform pump overhaul projects based solely on a pump's tested efficiency. As evident from past [redacted] years of experience offering incentives for pump overhauls, even 50% of program influenced overhauls identified and received incentive reservations are still not completed due to customer barriers. Limiting one incentive per customer will further limit important program services available to the customer through the PA. The PA supports the customer through project identification, quantification of savings, support with scope of work development, preliminary design support, quote review as necessary, construction management, final commissioning, and project closeout including measurement and verification of achieved savings. All these services are critical in ensuring a project, once identified, will result in installed savings impacting the electric grid. Therefore, we strongly believe all pumps meeting the eligibility criteria for the pump overhaul measure should be eligible for incentives, except for pumps previously incentivized, but have not exceeded their measure EULs.

In addition, it is important to note the following in support of the water, wastewater, and irrigation industries' need for technical expertise and financial assistance offered through SW WISE:

1) Most water districts/municipalities having separate water/wastewater services are operated by different divisions. Not only that, for customers with have multiple facilities, each facility is typically managed by non-overlapping teams. This complexity, in addition to staff turnover, makes active guidance from programs, such as SW WISE, extremely important to ensure continued efficiency restoration and operation of pumps through measures, such as pump overhaul.
2) The main drivers for most customers in the water, wastewater, and agricultural industries are to meet water quality and production demands, and to provide necessary treatment for wastewater. As such, the standard practice for most customers in these industries is to operate their pumps until there is a failure or significant drop in service level (GPM/water production) before any overhaul work is performed. Therefore, energy efficiency programs, such as the SW WISE program, help customers consider the energy consumption, the utility cost of operating their pumps, and available incentives to overhaul operational pumps (not failing) to result in more efficient operation.
3) The technical influence programs, such as SW WISE, provide on pump overhaul projects is extremely valuable. Based on existing pump curves, customer data, and operating conditions, SW WISE aims to provide technical expertise and assistance to influence customers in pursuing eligible pump overhaul scope of work resulting in the best efficiency improvements. As an example, the proposed scope of work for pump overhauls can vary from either of the following:
    a. Replacement of either or both pump bowl/volute and impeller, or
    b. Machine work (e.g., re-facing, pit and hole filling, replacing wear rings) to return either or both pump bowl and impeller to original condition, or
    c. Impeller trimming, or
    d. Addition or removal of a stage, and/or
    e. Complete pump replacement (including bare pump and mechanical equipment, driver and controls)
4) The SW WISE program provides technical expertise to assist customers to pursue the pump overhaul work meeting their requirements and achieves the best efficiency outcomes. Without the technical

influence of EE programs such as SW WISE, the customers may not achieve the best efficiency improvements. For example, the customer may only complete machining work when also the addition of a stage is needed (or trimming of its impeller is needed) to shift operation of pump to its best efficiency point.

5) The pump overhaul measure is an essential program offering based on SW WISE's Program Implementation Plan (PIP).
6) The water, wastewater, and agricultural customer segments are complex and vary in structure. As such, technical expertise and incentives help encourage customers in these segments to participate in energy efficiency projects. A CPUC report dated December 2020 helps demonstrate this complexity:
    a. There are a total of 93 regulated water utilities in California as follows:

Class	Service Connections	Count
Class A	> 10,000	9
Class B	2,000 <> 10,000	4
Class C	500 <> 2,000	20
Class D	< 500	60

    Based on this report, regulated water utilities in California can have active connections ranging between 7 connections (Class D) and 527,407 connections (Class A). The operations, management and the resources (such as budget allocation, number of staff) of these different water systems vary significantly and without the expertise SW WISE provides, determining potential pump overhaul projects meeting each customer's requirement is challenging.

    b. Even for large, regulated water utilities, such as [redacted], which owns and operates [redacted] throughout California, each district varies in size (i.e. number of pumps), follow different operating and maintenance procedures, are managed by separate personnel, and have various history participating in past incentive programs. Therefore, there's no "one size fits all" solution to pump overhauls for a customer and past participation does not carry over to future practices.

SW WISE aims to assist customers, both small and large, in finding energy efficiency solutions (such as pump overhaul) that work for them. Excluding past participants for incentives or previously overhauled incentivized pumps, past their EULs, will hinder the participation of water, wastewater and agricultural customers in energy efficiency programs, such as SW WISE. As there is no ruling specifying past participants in incentive programs can no longer participate, nor any ruling that past incentivized equipment can't be improved and incentivized again after its previous measure's EUL, and since program influence must be proven per Resolution E-5115, it is to our understanding every project application deserves a fair chance at eligibility and approval of influence regardless of single outlier information, such as past participation.

SCE agrees with [redacted] understanding of the intent of program influence and as long as it aligns with Resolution E-5115, SCE believes that the past participation should not be considered as a shower stopper.

(If Needed) CPUC Staff Clarifying Question(s) to PA
(If Needed) PA Response to CPUC Clarifying Question(s)
CPUC Response (6/15/2023) Please limit program participation and incentives for pump overhaul projects to a single pump per customer. Considering the customers' historical participation in pump overhaul programs and the regular provision of pump test results by SCE, it is important to avoid using ratepayer funds to incentivize the same measure repeatedly for the same customer and pump systems. This program is good for educating customers in order to change their business-as-usual practices to improved practices. Once customers have received the necessary education and achieved significant benefits from the program, there is no longer a compelling need for continued incentives. Therefore, we propose that going forward, program participation be restricted to a single incentive for a single pump per customer. **CPUC Response (7/15/2023)** We remove the requirement limiting the participation to only allow one pump per customer but require the PA to clearly document program influence according to E-5115 program influence requirements. The PA is also required to document customer standard practice. The underlying assumption that the customer would not perform pump overhauls in the absence of the PA's program or would wait until pumps fail before performing a refurbishment should be documented and fully supported by evidence for each project. For each application that involves pump overhauls, the PA must assess the customer's standard practice for identifying and overhauling pumps and should offer ratepayer incentives only to accelerate the normal practice. The baseline for each project must be the customer's normal practice for refurbishment. We do not allow the same pump to be incentivized multiple times, even if a certain period, such as three years, has passed since the original implementation. Participation in this program should be focused on improving maintenance practices rather than creating a long-term dependency on ratepayer funding in place of ongoing customer maintenance. As required for all BRO measures, the program is also required to document a 3-year maintenance and training plan for the customer. The PA is also required to clearly document whether the existing pump meets the level of service as expected by the customer. Program influence requirements should be documented at the customer level not for each individual project.

PA Response to CPUC Response

The SW WISE requests a revision to CPUC response given the below additional clarifying points.

Concerning the proposal of "program participation [being] restricted to a single incentive for a single pump per customer", on which policy is this based?

The following points of clarification are provided based on the CPUC's response.

1. SW WISE, as a Resource Acquisition program, is not an educational program. The technical and financial influence provided by the program identifies specific cost-effective pump overhaul projects, provides technical support on how to achieve a successful pump overhaul, and provides incentives to convince/influence customers to move forward with overhauls not previously planned.

   The information provided is specific to the pump and pump type. Learning the process and benefit of performing an overhaul on a single electric constant speed vertical turbine well pump on a water distribution system does not necessarily change the practices of the same customer's wastewater treatment facility, comprised of separate management and operations personnel with numerous electric vertical turbine booster pumps, centrifugal booster pumps, and submersible pumps on VFD pumping wastewater and solids at various phases of treatment. Likewise, with the education gained by the same customer on an electric pump does not necessarily apply to their gas-driven pumps. Furthermore, the customer's criteria and level of evaluation can vary significantly depending on the pump's size (e.g. a 50 HP pump vs a 300 HP pump) and the importance of the pump to their operation.

   As such, E-5115 is being followed and the appropriate influence rigor is being developed and included with every overhaul project going through the program to prevent free-ridership. **Therefore, it is requested E-5115 on a project-by-project basis be the qualifier of free ridership**.

2. SCE's pump testing services are no longer offered through PPP-funding. Additionally, SW WISE serves customers in service territories outside of SCE, where pump testing is performed by pump service companies, of which the results vary in quality. Oftentimes, we have encountered pump testing companies performing tests without ensuring the pumps are operating under normal conditions or only one test point was performed on variable load pumps, resulting in incorrect or incomplete test results. Historically, these pump tests have also only been performed on electric clean water or reclaim pumps, even though a multitude of gas-driven and wastewater pumps are operating without any insight as to their efficiency, and as such are unknowingly operated with lower efficiencies. As such, the provision of pump tests by SCE or subsidized pump tests by PG&E are not enough to change the maintenance practices of all pumping customers throughout CA, especially those customers in SCG and SDG&E territory, and non-clean water pumps (e.g. lift stations, wastewater, and oil and gas pumps).

Limiting program participation to a single pump per customer incorrectly assumes two things after overhaul of a single pump receiving incentives and services in ANY PPP funded energy efficiency program:

1. Customer has been educated to identify and install subsequent overhauls for all pumps throughout their water, wastewater, oil and/or gas pumping system(s).
2. Pump overhauls **based on efficiency** becomes each customer's standard practice.

The first point assumes every subsequent pump overhaul is free ridership. The second point assumes pump overhaul is standard practice, meaning there is no claimable savings above standard practice. If these

statements were true after the first pump overhaul participation in any PPP-funded EE program, limiting program participation to one overhaul per customer would be the correct decision. As the clarifying points show these assumptions are incorrect, E-5115 on a project-by-project basis should be the qualifier of overhaul eligibility.

EO Scope	
Describe the size of the applicable markets: Is the proposed set of measures applicable to a limited or broad market? Please give your best estimate for applicable market size (the range of like customers or plants): ☐ Small (under 20) ☒ Large (100+) ☐ Other (please specify_____) Estimate the size of the incentive per project associated with a project subject to the EO review ☐ < $7500 ☐ $7500 – $25000 ☐ $25000 – $100000 ☐ $100000 ☒ N/A or unknown	
EO Category	☒ Policy ☐ Measure Performance ☒ Baseline ☒ Calculation Technique ☐ Documentation Requirements ☒ Program Influence ☐ Other (describe)
If Policy, SW Rulebook Section and Rule Affected	
Measure Description	
Industry/Market Sector	☐ Residential ☒ Commercial ☒ Industrial ☒ Agricultural ☐ Cross cutting ☐ Other (describe)