

Final Ex Ante Review Findings

Table 1-1: Project Information

Program Administrator (PA)	PG&E
Application ID	1445-13-1436
Application Date	5/24/2013
Program ID	PGE
Program Name	Oil and Gas Production Energy Efficiency Program
Program Year	2012
CPUC Staff Project ID	X364
PA Ex Ante Savings Date	7/26/2013
Measure Name	New Steam Generator
Project Description	The project entails installing two measures: 1) VFDs on new steam generator feed water pump and combustion air fan, and 2) a split pass design of the steam generator in lieu of the baseline single pass configuration.
Date of CPUC Staff Review	4/20/2015
Primary Reviewer / Firm	Keith Rothenberg / Energy Metrics
Review Supervisor / Firm	Leonel Campoy / Itron
CPUC Staff Project Manager	██████████ / California Public Utilities Commission, Energy Division
CPUC Staff Policy Authorization (as needed)	
Type of Review (Desk, On-site, Full M&V, Tool)	Desk
CPUC Staff Recommendation	CPUC Staff finds issues with the as-submitted ex ante savings for this project. The PA must provide additional post-installation measurement data and revise the impacts. Documentation reflecting the additional post-installation measurement data, revised final ex ante savings estimates, and final incentives must be uploaded to the CMPA upon completion. CPUC Staff will not review this project further and the PA may proceed to project close out upon fulfilling the requested actions. A 0.41 NTGR for this project was previously determined.

Measure Description

The project includes two energy saving measures on a new 85 MM BTU/HR steam generator. The first measure is to install an efficient split pass design in the new steam generator compared to a single pass configuration baseline. The second measure is to install two Variable Frequency Drives (VFDs): one on a new 250 HP steam generator feed water pump and one on a 150 HP combustion air fan motor.

Summary of Review

Pacific Gas & Electric (PG&E) submitted the following documents to CPUC Staff for this final review on March 26, 2015:

- 1445-13-1436 Checklist 150219_apf3.xlsx;
- CPC_1445-13-1436.pdf;
- CR_1445-13-1436.pdf;
- EAR Reponses_PGE 1445-13-1436_X364.pdf;
- EE_Results_1445-13-1436_VSD_for_SG_and_SP_Design.xlsx;
- FanSave 1445-13-1436_76.39pct.xlsx;
- Invoices_1445-13-1436.pdf;
- PGE 1445-13-1436 X364 Phase I EAR.pdf;
- PGE 1445-13-1436 X364 Phase II EAR; and
- Post-Field Inspection wPics_1445-13-1436.pdf

In response to CPUC Staff's data request following the Phase I ex ante review, PG&E stated that the customer's existing lease property has six (6) split pass steam generators in operation which were installed between 2012 and 2013. CPUC Staff performed a NTG review for the project. The customer's site engineer stated during the NTG interview that technical considerations were evaluated by the customer's engineering staff comparing the split pass vs. single pass steam generator configurations. The customer representative stated that steam pressure requirements and the length of piping runs are usually the governing factors in the selection of steam generator design. The split pass configuration was chosen for this application based on the steam pressure requirement at the well heads.

The CPUC Staff consultant interviewed a leading local manufacturer and installer of single and split pass steam generators. The representative advised during the interview that 90% of his customers choose the VFD option with the split pass design. The interview findings provided very strong evidence that the VFD as an add-on measure for a new split pass steam generator is industry standard practice (ISP). Also, the interviewee indicated that using the split pass design is cost-effective for large operators and it is their standard practice to purchase and install split pass

generators instead of single pass steam generators. The PA did not provide any supporting documentation for its claim that the measure is not ISP.

Based on CPUC Staff's preliminary findings, an ISP study was initiated. The conclusion of the study is that the VFDs on feed water pumps and combustion air fans as well as the split pass steam generator design are ISP. These measures were sunset from energy efficiency program participation following the completion of the ISP study. This project is allowed to claim these measures since the project application was executed prior to the ISP determination.

The PA had proposed a one month post M&V period for savings true up. CPUC Staff required that period be revised to at least two months.

The PA has submitted the post installation documentation for the project. The post installation annual ex ante energy savings estimates are 114.6 kW and 983,903 kWh. Therms impacts are not claimed in this application. The incremental project cost is \$178,117 and the incentive is \$100,012 which is more than 50% of the incremental cost. The PA must confirm that this does not violate its Oil and Gas Production Energy Efficiency Program rules.

CPUC Staff reviewed the "EE_Results_1445-13-1436_VSD_for_SG_and_SP_Design.xlsx" workbook and found that data in the "SG200H Oper Log" spreadsheet tab is missing for the period of 12/8/14 - 12/15/14. The PA must provide this data. If these data are not available, 60 days of consecutive data must be provided and used in the analysis. If the unit was off during this period, then these data must be used to estimate the total annual hours of operation for the project (zero hours for seven days). Additionally, the project documentation must clearly identify what data are measurements and what data are calculated in the "SG200H Oper Log" spreadsheet tab.

Impacts associated with split pass design appear overestimated. The split pass pressure drop calculated from the data provided by the PA is 76.5 psig, not 58.8 psig as theoretically estimated and used in the final ex ante savings analysis. The single pass pressure drop is likely overestimated (954.3 psi). During the 2013 ex post evaluation (site numbers E30013 and E30014), at the evaluation team's request, the same customer installed new pressure gauges and measured the pressure drop on a 50 MM BTUH input single pass steam generator unit at another facility. The pressure drop was found to be 540 psi drop (inlet feed water pressure-steam pressure).

The PA savings calculation uses the maximum design flow rate (181 GPM) instead of the measured flow rate (156.5 GPM) to calculate the savings impacts for the split pass design.

In the absence of better information, 540 psi should be used as the single pass pressure drop (inlet feed water pressure-steam pressure) and 156.5 GPM or the average GPM determined from

the complete data set should be used for the savings analysis. Making these corrections and using the PA's current estimated hours of operation reduces the saving impacts for this measure from 745,930 kWh and 86.9 kW peak demand reduction to an estimated 331,708 kWh and 38.6 kW peak demand reduction. This represents a 56% reduction in the impacts for this measure. The total project impacts would be reduced from 114.6 kW and 983,903 kWh to 66.4 kW and 611,962 kWh.

CPUC Staff were remiss in not requiring the PA to provide a detailed M&V plan for this project. The lack of a detailed M&V plan has led to poor execution of the post installation true-up for this project, resulting in unreliable savings estimates. The PA neglected to use measured values in lieu of estimated values for the feed water flow rate and made no effort to confirm the pressure drop through a single pass steam generator. This assumption, the pressure drop through a single pass steam generator, is one of the most important factors in the ex ante savings analysis for this project. Additionally, no data logging of either the pump motor or fan motor power were performed to further reduce uncertainty in the ex ante savings estimates. The ex ante savings estimates for these measures are based on spot measurements. The primary parameter that the PA determined from the data provided by the customer is the annual operating hours of the steam generator, and there are seven days of missing data that are not explained.

The purpose of M&V is to reduce the uncertainty of the savings impact analysis and increase the reliability of the savings estimates. The PA failed to identify the critical parameters and their uncertainty for this project. The PA did not design an M&V plan to reduce the uncertainties associated with the critical parameters. Projects must not be approved to proceed to implementation until a well-conceived M&V plan has been designed, documented, reviewed and approved. The PA reviewers must be diligent in reviewing the implementer's projects and ensure that all reasonable efforts are made to increase the reliability of the savings estimates.

Review Conclusion

1. CPUC staff finds issues with the as-submitted ex ante savings for this project. The NTGR for this project was previously determined to be 0.41. The PA must take the action steps described below to provide additional post installation measurement data and revise the savings calculations. Revised project documentation reflecting the final ex ante savings estimates, final incentive, and all final project documentations must be uploaded to the CMPA folder for this project upon project completion. CPUC staff will not review this project further, and the PA may proceed to project close out upon fulfilling the below requested actions. CPUC staff may follow-up on this project in the future to determine whether the PA correctly acted upon the CPUC staff requested action items in this disposition.

Summary of CPUC Staff Requested Action by the PA

CPUC Staff requires that the PA perform the following actions for this project:

1. Data on the “SG200H Oper Log” spreadsheet tab in the “EE_Results_1445-13-1436_VSD_for_SG_and_SP_Design” workbook is missing data for the period of 12/8/14 - 12/15/14. The PA must provide this data. If these data are not available, 60 days of consecutive data must be provided and used in the analysis. If the steam generator unit was off during this period, then these data (zero operating hours for seven days) must be used to estimate the total annual hours of operation for the project-this would reduce the annual hours estimate to 7,708.
2. The project documentation must clearly identify what data are measurements and what data are calculated on the “SG200H Oper Log” spreadsheet tab.
3. In the absence of better information, 540 psi must be used as the single pass pressure drop (inlet feed water pressure-steam pressure) and 156.5 GPM or the average GPM determined from the complete data set should be used for the savings analysis.
4. The PA must explain and justify why the proposed incentive (\$100,012) is more than 50% of the incremental project cost (\$178,117), that this does not violate the PA’s own program rules.
5. Provide the EUL for each measure. This information was previously requested and was not provided.
6. Revised project documentation reflecting the final ex ante savings estimates, final incentive, and all final project documents must be uploaded to the CMPA folder for this project. CPUC Staff will not review of this project further. The PA may proceed to close out this project without waiting for further CPUC Staff review once all the requested actions are fulfilled.
7. Upload a separate document with a file name “Claim ID” to the CMPA. The Claim ID document will include the PA claim ID number and quarter claimed.
8. The PA must discuss this ex ante review with its reviewers and determine how to improve its procedures for future projects to avoid similar issues.

For all future projects (submitted after receipt of this review):

1. The PA shall make a diligent effort to ensure that custom project savings calculation methodologies and M&V plans are carefully designed to provide reliable savings estimates in accordance with good engineering practice, CPUC policies, and PA program rules. Projects must not be approved to proceed to implementation until a well-conceived M&V plan has been designed, documented, reviewed and approved. The PA reviewers must be diligent in reviewing the implementer’s projects and ensure that all reasonable efforts are made to increase the reliability of the savings estimates.

The purpose of M&V is to reduce the uncertainty of the savings impact analysis and increase the reliability of the savings estimates. The PA failed to identify the critical, uncertain parameters for this project and failed to design an M&V plan either to reduce or eliminate the uncertainty associated with those factors. Measured values such as the feed water flow rate were not used in the true-up analysis. No effort was made to verify the pressure drop through a single pass steam generator. Data logging was not performed on either the feed water pump or the combustion air fan to determine their power consumption.

Table 1-2 Review Findings

Reviewed Parameter	Analysis
<p>Project Baseline Type (Early Replacement, Normal Replacement, Capacity Expansion, New Construction, System Optimization, Add-on Measures) Note: For early retirement projects only, include RUL through EUL baseline)</p>	PA Proposal: New Construction
	CPUC Staff Assessment: New Construction
	CPUC Staff Recommendation: None
<p>Project Baseline Technology (in situ equipment, Title 24 (specify year), other code or other efficiency level (specify), industry standard practice - ISP)</p>	PA Proposal: The proposed measures are ISP.
	CPUC Staff Assessment: The proposed measures – split pass design and VFDs – were determined to be ISP. This project was allowed to proceed because the project application was executed prior to the ISP determination.
	CPUC Staff Recommendation: These measures are waived from the ISP requirement for this project and sunset from future program participation.
<p>Project Cost Basis (Full Incremental, or Both. Note: For early retirement projects, include RUL through EUL cost basis treatment)</p>	PA Proposal: Incremental cost
	CPUC Staff Assessment: Incremental Measure Cost
	CPUC Staff Recommendation: None
<p>RUL (required for early retirement projects only, otherwise N/A)</p>	PA Proposal: N/A
	CPUC Staff Assessment: N/A
	CPUC Staff Recommendation: N/A
<p>EUL (for each measure)</p>	PA Proposal: Not provided
	CPUC Staff Assessment: VFDs on pumps and fan motors is 15 years; design layout configuration measure will need further assessment
	CPUC Staff Recommendation: Provide EUL for split pass steam generator.
<p>Savings Assumptions</p>	PA Proposal: PA expects the plant will operate for 8,585 hours in the first year. The pressure drop through the single pass steam generator is theoretically calculated to be 954 psig. The maximum design flow rate (181 GPM) was used in the savings analysis.
	CPUC Staff Assessment: The PA failed to identify the critical, uncertain parameters for this project and failed to design an M&V plan either to reduce or eliminate the uncertainty associated with those factors. Measured values such as the feed water flow rate were not used in the true-up analysis. No effort was made to verify the pressure drop through a single pass steam

Reviewed Parameter	Analysis
	<p>generator. Data logging was not performed on either the feed water pump or the combustion air fan to determine their power consumption.</p> <p>CPUC Staff Recommendation: In the absence of better information, 540 psi must be used as the single pass pressure drop (inlet feed water pressure-steam pressure) and 156.5 GPM or the average GPM determined from the complete dataset should be used for the savings analysis. The annual hours of operation must be estimated based on 60 days of consecutive data.</p>
<p>Calculation Methods/Tool review</p>	<p>PA Proposal: An energy savings calculation workbook was provided for CPUC Staff review.</p> <p>CPUC Staff Assessment: Calculation methodology acceptable, post installation true-up not approved.</p> <p>CPUC Staff Recommendation: The PA must true-up the savings analysis as directed in this review.</p>
<p>Pre- or Post-Installation M&V Plan</p>	<p>PA Proposal: M&V plan was submitted for ED review</p> <p>CPUC Staff Assessment: One month of post M&V period was specified by the IOU</p> <p>CPUC Staff Recommendation: ED recommended that the post M&V period be revised to at least two (2) months. CPUC Staff have found that the PA's M&V efforts for this project exhibit a lack of critical thought and planning. The purpose of M&V is to reduce the uncertainty of the savings impact analysis and increase the reliability of the savings estimates. The PA failed to identify the critical uncertain parameters for this project and failed to design an M&V plan to reduce or eliminate the uncertainty associated with those factors. Measured values such as the feed water flow rate were not used in the true-up analysis. No effort was made to verify the pressure drop through a single pass steam generator. Data logging was not performed on the feed water pump or the combustion air fan to determine their power consumption.</p>
<p>Net-to-Gross Review</p>	<p>PA Proposal: Not provided</p> <p>CPUC Assessment: The factors considered important in the decision to install the split pass configuration for the steam generator included the availability of the rebate (8), previous experience with this type of measure and this program (7 and 7), payback on the investment (9), age of the existing equipment (8), recommendation from a vendor (8), corporate policy and guidelines (9), and compliance with air regulations (9). When the respondent was asked how 10 points would be allocated across programmatic and non-programmatic factors, the respondent gave 5 points to the program and 5 to non-program factors. In addition, if the program did not exist, the respondent said the likelihood of installing the same equipment was 5 out of 10.</p> <p>CPUC Staff Recommendation: 0.41</p>

Table 1-3 Energy Savings Summary, Project Costs & Incentive

Description	IOU Ex Ante Claim	ED Recommendations
First Year kWh Savings	983,903	TBD
First Year Peak kW Savings	114.6	TBD
First Year Therms Savings	0	TBD
kWh Savings (RUL Period)	N/A	N/A
Peak kW Savings (RUL Period)	N/A	N/A
Therms Impact (RUL Period)	N/A	N/A
kWh Savings (RUL thru EUL Period)	N/A	N/A
Peak kWh Savings (RUL thru EUL Period)	N/A	N/A
Therms Savings (RUL thru EUL Period)	N/A	N/A
Annual Non-IOU Fuel Impact (RUL Period)	N/A	N/A
Annual Non-IOU Fuel Impact (RUL thru EUL Period)	N/A	N/A
Project Costs for Baseline #1 (RUL or EUL)	\$178,117	\$178,117
Project Costs for Baseline #2 (EUL minus RUL period)	N/A	N/A
Project Incentive Amount	\$100,012	TBD