

Phase II Ex Ante Findings

Table Error! No text of specified style in document.-1: Project Information

IOU	PG&E
Application ID	Sales Lead 25543
Application Date	2/28/2012
Program ID	PGE2222
Program Name	Energy Efficiency Services for Oil Production
Program Year	2012
Itron Project ID	X196
IOU Ex Ante Savings Date	4/30/2013
Measure Name	Insulate New Steam & Hot Fluid Pipes
Project Description	Install for new construction 3” mineral wool insulation on 191,000 feet of “open field” oilfield pipelines.
Date of CPUC Staff Review(s)	1/16/2013, 5/9/2013 & 11/7/2013
Primary Reviewer / Firm	Joseph Ball / Itron
Review Supervisor / Firm	Nikhil Gandhi/ Strategic Energy Technologies, Inc.
CPUC Staff Project Manager	████████████████████ ████████████████████
CPUC Policy Authorization (as needed)	TBD
Type of Review (Desk, On-site, Full M&V, Tool)	Desk
CPUC Staff Recommendation	Ex ante energy savings are conditionally approved, pending post-install M&V and true-up of energy savings.

Measure Description

Insulate 191,000 feet of new steam and hot fluid pipes of various diameters. Three (3") inches of mineral wool fiber and aluminum jacket sleeving will be used on all pipes regardless of the diameter. The adjusted-IOU equipment baseline specified 2" thick mineral wool insulation.

The total project energy savings estimates were re-calculated to be 451,568 therms, with an incentive capped at 50% of the capital costs of \$462,600, or \$231,300.

Summary of Review

After an initial show-stopper review in October of 2012, CPUC staff conducted a mini-ISP, which was delivered to PG&E on February 6, 2013 and resulted in an ISP baseline of 2" of mineral wool insulation for hot outdoor oilfield pipelines. From this CPUC staff directed the IOU via the parallel review process to adjust the baseline using separate NAIMA E3 Plus model runs and re-submit the energy savings, resulting in a large reduction in therm savings over the original bare pipe, but still with significant incremental energy savings.

From CPUC staff's suggestion PG&E also submitted a post-installation M&V plan on April 23rd 2013. The plan was reasonable but lacked specific monitoring intervals. The M&V plan asked for pipe temperatures at both the generator and well head. CPUC staff suggests that additional post-install pipe surface temperatures be measures every 2000 feet of pipe at available pipe joints, valves or trap where insulation is not installed. The M&V plan did not include measuring the combustion efficiency of the new steam generator. CPUC staff also notes that the IOU savings calculations did not include the boiler efficiency; including this efficiency will likely increase energy savings estimates.

Furthermore, CPUC staff questioned why incremental cost for the larger 4" diameter pipe was less than for 3" diameter pipe. The vendor modified the incremental costs of the 3" diameter pipe to match the 4" diameter pipe at \$1.10 per linear foot. During the parallel review CPUC staff asked PG&E to provide the incremental costs broken out by material and labor costs between the baseline 2" mineral wool and the proposed 3" mineral wool insulation. The vendor provided the incremental costs, however, they did not provide the breakdown between material and labor claiming strict confidentiality of those cost estimates. CPUC staff finds this unacceptable. **After the post-install M&V period for this project, CPUC staff requires that the final invoices submitted for this project must include the material and labor costs broken out.** Nonetheless CPUC staff re-calculated the overall project incremental costs to be \$360,600, with a 50% cap the incentive would be \$180,300.

Review Conclusion

Ex ante energy savings are conditionally approved pending post-install M&V and true-up of energy savings including modified NAIMA 3E Plus simulations to mimic actual conditions found during verification, if different than assumed.

Summary of CPUC Staff Requested Action by the IOU

CPUC staff requests that the IOU undertake the recommended steps and perform the following tasks during the post-install M&V period and afterward:

1. Adjust the M&V plan to measure pipe surface temperatures measured every 2000 feet of pipeline for each of the four diameters: 4", 6" and 10". For the 3" diameter long pipeline (120,000 ft), take pipe surface temperature readings every 4000 feet of pipe.
2. Follow the rest of the M&V plan that includes verifying the operating hours, system pressures and set-point temperatures.
3. Measure the combustion efficiency of the steam boiler; take at least 5 readings and throw out any outliers.
4. Modify the NAIMA input assumptions for system temperatures, hours of use, surface temperatures boiler combustion efficiency, and include both baseline runs (2" insulation) and actual (3" insulation).
5. Submit final invoices that include the material and labor costs broken out separately.

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, Major Renovation) Note: For early retirement projects only, include RUL through EUL baseline)</p>	IOU Proposal: New Construction
	CPUC Staff Assessment: Accepted
	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>	IOU Proposal: ISP baseline of 2” thick mineral wool insulation w/ aluminum jacket sleeving.
	CPUC Staff Assessment: Accepted
	CPUC Staff Recommendation: None
<p>Project Cost Basis (Full, Incremental, or Both. Note: For early retirement projects, include RUL through EUL cost basis treatment)</p>	IOU Proposal: Incremental cost = \$462, 600
	On 10” pipe: \$19.50 /foot of 3” mineral wool - of \$15.05/foot of 2” mineral wool @ 40,000 ft
	On 6” pipe: \$12.70 /foot of 3” mineral wool - \$10.50/foot of 2” mineral wool @ 15,000 ft
	On 4” pipe: \$10.60 /foot of 3” mineral wool - \$9.50 /foot of 2” mineral wool @ 16,000 ft
	On 3” pipe: \$10.10 /foot of 3” mineral wool - \$9.50 /foot of 2” mineral wool @ 120,000 ft
CPUC Staff Assessment: Incremental cost	
\$4.45/foot incremental cost for the 10” diameter pipe insulation @ 40,000 ft	
\$2.20/foot incremental cost for the 6” diameter pipe insulation @ 15,000 ft	
\$1.10/foot incremental cost for 4”pipe @ 16,000 ft	
\$1.10/foot incremental cost for 3” diameter pipe insulation @ 120,000 ft,	
CPUC Staff recommendation: Upon project completion provide CPUC Staff a copy of invoices that include a breakdown of labor and material costs for the baseline and proposed cases.	
<p>RUL (required for early</p>	IOU Proposal: N/A

Phase II Ex Ante Review Findings

Reviewed Parameter	Analysis
retirement projects only, otherwise N/A)	CPUC Staff Assessment: N/A
	CPUC Staff recommendation: N/A
EUL (for each measure)	IOU Proposal: Not provided
	CPUC Staff Assessment: During CPUC staff’s mini-ISP study, design engineers & manufacturers provided 5-20 year range of life expectancies for pipe insulation projects with aluminum sleeving. The life expectancy would increase if galvanized or stainless steel jacket sleeving is specified (an uncommon practice). In the field, aluminum sleeving can and will be damaged due to human error over time compromising the efficacy of the thermal properties.
	CPUC Staff Recommendation: EUL is 10 years for pipe insulation w/ jacket sleeving
Savings Assumptions	IOU Proposal: NAIMA 3E Plus assumptions are as follows: <ul style="list-style-type: none"> ▪ Fluid line pumping or flowing 7000 hours annually ▪ Flow lines steaming for 1300 hours annually ▪ Average hot fluid line temperature estimated to be 200°F ▪ Average steam line temperature estimated to be 550°F ▪ Average ambient temperature assumed to be 75°F ▪ Average wind speed estimated to be 7 mph ▪ Bare surface emittance is 0.8 ▪ Pipe is steel and horizontal ▪ Baseline is 2” mineral wool insulation ▪ Proposed is 3” mineral wool insulation ▪ 10” steam pipelines total 40,000 feet long ▪ 6” steam pipelines total 15,000 feet long ▪ 4” steam pipelines total 16,000 feet long ▪ 3” hot fluid pipelines total 120,000 feet
	CPUC Staff Assessment: All of the NAIMA model input assumptions listed are acceptable and the steam pipe thermal efficiencies are generated, however, there is no assumed boiler combustion efficiency noted in the calculations.
	CPUC Staff Recommendation: These parameters will be verified during post-install M&V and IOU true-up, especially hours of steam and hot liquid pipe flows and surface temperatures. A flue gas analysis is recommended to determine the combustion efficiency of the boiler.
Calculation Methods/Tool review	IOU Proposal: NAIMA 3-Plus calculator tool was used to estimate savings by running two simulations: A baseline and proposed simulation with the difference being the energy savings of the project.
	CPUC Staff Assessment: Calculation tool and methodology are accepted.
	CPUC Staff Recommendation: For post-install M&V provide the NAIMA

Phase II Ex Ante Review Findings

Reviewed Parameter	Analysis
	inputs and outputs for both simulation runs that include any parametric changes identified during post-install M&V described below. Calculate savings for each section of 2000 ft pipe using the average of the two measured temperatures, i.e. at the beginning and end of the 2000 ft section.
Pre- or Post- Installation M&V Plan	IOU Proposal: M&V plan provided
	CPUC Staff Assessment: M&V plan is reasonable with the following additions: <ol style="list-style-type: none"> 1. Measure the new steam boiler combustion efficiency after commissioning is complete using a flue gas analyzer. 2. Provide trend data showing hours of steam and hot liquid pipe flows over the two-week measurement period. 3. Take pipe surface temperature readings not only at the header and the well head but at every 2000 feet of pipe (for the 10, 6 and 4 inch diameter pipes). For the 3" diameter pipes, take pipe surface temperature readings every 4000 feet of pipe.
	CPUC Staff Recommendation: As described above.
Net-to-Gross Review	IOU Proposal: Not provided
	CPUC Staff Assessment: Not assessed
	CPUC Staff Recommendation: None

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

Description	IOU Ex Ante Claim	CPUC Staff Recommendations
First Year kWh Savings	N/A	N/A
First Year Peak kW Savings	N/A	N/A
First Year Therms Savings	451,568	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 (EUL - RUL Period)	N/A	N/A
Peak kW Savings (EUL - RUL Period)	N/A	N/A
Therms Savings (EUL - RUL Period)	451,568	TBD
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)	N/A	N/A
Project Costs for Baseline #2 (EUL - RUL period)	\$462,600	\$360,600.00 (as re-calculated by CPUC staff) to be finalized after invoices are provided
Project Incentive Amount	\$231,300	TBD