

## Phase 1 Ex Ante Review Report

**Table 1-1: Project Information**

<b>IOU</b>	PG&E
<b>Application ID</b>	Sales Lead 25543
<b>Application Date</b>	2/28/2012
<b>Program ID</b>	PGE2222
<b>Program Name</b>	Energy Efficiency Services for Oil Production
<b>Program Year</b>	2012
<b>Itron Project ID</b>	X196
<b>IOU Ex Ante Savings Date</b>	TBD
<b>ED Measure Name</b>	Insulate new steam pipes
<b>Project Description</b>	Install for new construction 3” mineral wool insulation on 191,000 feet of “open field” oilfield pipelines
<b>Date of ED Review(s)</b>	1/16/13
<b>Primary Reviewer and Firm</b>	Joseph Ball/Itron
<b>Review Supervisor and Firm</b>	Nikhil Gandhi/ Strategic Energy Technologies, Inc.
<b>Type of Review (Desk, On-site, Full M&amp;V, Tool)</b>	Desk
<b>ED Recommendation</b>	Ex ante savings are not approved, pending baseline adjustment for industry standard practice (ISP) for insulating new steam and hot fluid pipes. ED’s ISP study concluded that 2” mineral wool insulation with aluminum jacket sleeving is ISP for all pipes connected between the steam generator and well pads.

## **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 IOU claimed equipment baseline is un-insulated, bare pipe. Total project energy savings estimates were calculated to be 40,252,404 therms, with an incentive capped at 50% of the project total costs of \$1,195,450 (\$597,725).

## **Summary of Review**

The IOU submitted the following documents to the Energy Division (ED) for the project’s Ex Ante Review:

- XXXXXX Pipeline Insulation Highway XXX Project.pdf
- A .PDF file of NAIMA 3EPlus V4.1 – Program Calculation Sheets
- California Code of Regulations, General Industry Safety Orders – Title 8, Section 3308
- A .PDF of Savings by Design application form.

The Energy Division (ED) reviewed the project documentation. This document defined this as a new construction project, and included a Savings by Design pre-application dated 2/28/2012. As a new construction project, an industry standard practice baseline is applicable for calculating energy savings. Hence, ED conducted a mini industry standard practice (ISP) baseline study that targeted primarily design engineering firms with process steam piping experience for steam injection into California oil wells.

The baseline claim of bare pipe was investigated by ED through a mini-ISP baseline study that included interviews with eight (8) industry experts – six steam process design engineers, one (1) pipe insulation manufacturer & installer, and one (1) major oil producer. ED determined that for new construction of steam and hot fluid pipelines for injection into wells, the standard practice is to install 2” of mineral wool insulation with aluminum jacket sleeving. **Therefore, projects proposing insulation having conductivities (or k-values) less than the equivalent of 2” mineral wool insulation will not qualify for incentives.**

In regard to California Code of Regulations, General Industry Safety Orders document provided by the IOU is superseded by OSHA safety standards of hot surface temperatures are required to be below 140°F for workers. In addition open field pipe surfaces would also need to be below the same 140°F threshold for the safety of cattle and other wildlife prevalent to those areas.

## **Review Conclusion**

Ex ante energy savings are not approved pending adjustment of the baseline and subsequent re-calculation of energy savings. ED will provide PG&E the results of the ISP baseline study after it has been through CPUC review and approval.

### **Summary of ED Requested Action by the IOU**

The ED requests that the IOU perform the following actions to allow the completion of the Ex Ante Review:

1. Modify the baseline bare pipe to be 2” thick mineral wool insulation with aluminum jacketing (or equivalent k-value) for all 191,000 feet of steam pipe.
2. Revise energy saving calculations and re-submit for ED review.
3. Provide installed cost estimates for 2” mineral wool insulation, and use the difference between the 3” installation cost (\$2,390,000) and the 2” estimate as the incremental cost for which the incentive is determined.
4. Submit an M&V plan; consider using ED’s recommended M&V plan listed in Table 1-3 below.

**Table 1-1: Project Overview**

Description	IOU Proposed Ex Ante Data	ED Recommendations
<b>Project Baseline Type (Early Replacement, Normal Replacement, Capacity Expansion, New Construction, System Optimization, Add-on Measures)</b>	New Construction baseline; Bare (un-insulated) steam and hot fluid pipes	New construction. ISP for new construction is to insulate all steam & hot fluid pipes between the steam generator and the well pads
<b>Project Cost Basis (Full Cost, Incremental Cost)</b>	Full costs: \$2,390, 900 On 10” pipe: \$19.50 /foot of 3” mineral wool @ 40,000 ft On 6” pipe: \$12.70 /foot of 3” mineral wool @ 15,000 ft On 4” pipe: \$10.50 /foot of 3” mineral wool @ 16,000 ft On 3” pipe: \$10.45 /foot of 3” mineral wool @ 120,000 ft	Incremental cost applies. Obtain the installed cost of the baseline 2” mineral wool insulation w/ aluminum jacket sleeving for all four (4) different pipeline runs - pipe diameters of 10, 6, 4 and 3 inches. The installed price difference between 2” and 3” thick mineral wool insulation will be the incremental cost used to determine the incentive amount.
<b>RUL</b>	N/A	N/A
<b>EUL</b>	Not provided	EUL of pipe insulation w/ jacket sleeving is 10 years based on ED’s ISP baseline study
<b>First Year kWh Savings</b>	N/A	N/A
<b>First Year Peak kW Savings</b>	N/A	N/A
<b>First Year Therms Savings</b>	40,252,404	TBD
<b>kWh Savings (RUL Period)</b>	N/A	N/A
<b>Peak kW Savings (RUL Period)</b>	N/A	N/A
<b>Therms Impact (RUL Period)</b>	N/A	N/A

*Ex Ante Review Findings*

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<b>Description</b>	<b>IOU Proposed Ex Ante Data</b>	<b>ED Recommendations</b>
<b>kWh Savings (RUL thru EUL Period)</b>	N/A	N/A
<b>Peak kW Savings (RUL thru EUL Period)</b>	N/A	N/A
<b>Therms Savings (RUL thru EUL Period)</b>	N/A	N/A
<b>Annual Non-IOU Fuel Impact (RUL Period)</b>	N/A	N/A
<b>Annual Non-IOU Fuel Impact (RUL thru EUL Period)</b>	N/A	N/A
<b>Net-to-Gross Ratio</b>	Not provided	Not assessed

**Table 1-2: Detailed Review Findings**

Reviewed Parameter	Analysis
<b>Project Gross Savings Baseline</b> (for early retirement projects only, include RUL through EUL baseline)	IOU Proposal: New Construction, bare pipe
	ED Assessment: New Construction, ISP revealed 2” mineral wool insulation with aluminum jacket sleeving.
	ED Recommendation: Modify the baseline condition and revise the NAIMA 3EPlus software calculations
<b>Project Cost Basis</b> (for early retirement projects only, include RUL through EUL cost basis treatment)	IOU Proposal: Full cost
	ED Assessment: Incremental cost always apply for new construction projects
	ED recommendation: Submit incremental project cost breakdown using invoices or quotations.
<b>RUL</b> (required for early retirement projects only, otherwise n/a)	IOU Proposal: N/A
	ED Assessment: N/A
	ED recommendation: N/A
<b>EUL</b>	IOU Proposal: Not provided
	ED Assessment: Design engineers & manufacturers provided a 5-20 year range of life expectancy on 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.
	ED Recommendation: 10 years for pipe insulation with jacket sleeving;
<b>Savings Assumptions</b>	<p>IOU Proposal: The following are assumed to be the average and annual operating conditions:</p> <ul style="list-style-type: none"> <li>▪ Fluid line pumping or flowing 7000 hours annually</li> <li>▪ Flow lines steaming for 1300 hours annually</li> <li>▪ Average hot fluid line temperature estimated to be 200°F</li> <li>▪ Average steam line temperature estimated to be 550°F</li> <li>▪ Average ambient temperature assumed to be 75°F</li> <li>▪ Average wind speed estimated to be 7 mph</li> <li>▪ Bare surface emittance is 0.8</li> <li>▪ Pipe is steel and horizontal</li> <li>▪ Baseline is bare steel pipe</li> <li>▪ Proposed is 3” mineral insulation</li> </ul>

*Ex Ante Review Findings*

<b>Reviewed Parameter</b>	<b>Analysis</b>
	<ul style="list-style-type: none"> <li>▪ 10” steam pipelines total 40,000 feet long</li> <li>▪ 6” steam pipelines total 15,000 feet long</li> <li>▪ 4” steam pipelines total 16,000 feet long</li> <li>▪ 3” hot fluid pipelines total 120,000 feet</li> </ul>
	<p>ED Assessment: All of the model input assumptions listed are reasonable and accurate except that the following changes are needed to revise calculations based on adjusted ISP baseline:</p> <ul style="list-style-type: none"> <li>▪ ISP baseline is 2” thick mineral wool insulation w/ aluminum jacket</li> <li>▪ Both baseline temperatures used - 550°F average steam pipe temperatures and 200°F hot fluid pipe surface - will need to be adjusted downward to account for reduced aluminum sleeving temperatures that will exist in the baseline case.</li> <li>▪ Use bare surface emittance for aluminum jacket material (not steel pipe)</li> </ul> <p>Note: It may be easier to run two NAIMA simulations rather than one. The difference in energy usage between the two simulations will be the savings.</p>
	<p>ED Recommendation: Change baseline insulation level from un-insulated to 2” of mineral wool insulation with aluminum jacket sleeving</p>
<b>Calculation Methods/Tool review</b>	<p>IOU Proposal: NAIMA 3-Plus calculator Tool was used to estimate</p>
	<p>ED Assessment: Calculation Tool is an acceptable tool for estimating energy usage using various types of insulating materials under various conditions.</p>
	<p>ED Recommendation: Revise inputs to the NAIMA calculator for the baseline insulation level, as recommended in section above on savings assumptions.</p>
<b>Pre- or Post-Installation M&amp;V Plan</b>	<p>IOU Proposal: Not provided</p>
	<p>ED Assessment: None</p>
	<p>ED Recommendation: After installation of the new insulation, the following M&amp;V should be conducted:</p> <ol style="list-style-type: none"> <li>1. Verify that 191,000 feet of 3” mineral wool insulation with aluminum jacket sleeving was installed.</li> <li>2. To confirm annual boiler runtime, install two Hobo temperature loggers with the type-K thermocouple for a minimum of two weeks at 5-minute intervals. Be sure to “tuck” the thermocouple under the edge of the insulation and use conductive tape to hold in position, this</li> </ol>

*Ex Ante Review Findings*

<b>Reviewed Parameter</b>	<b>Analysis</b>
	<p>will ensure a good connection and protect the logger from moisture as well as direct contact from the sun. Position one logger at the beginning of the 3” hot fluid pipes under the new insulation placing the thermocouple on the pipe surface. Locate the second logger at the beginning of the 10” diameter steam pipes (just after the boiler outlet where the insulation begins). Note: A redundant Hobo logger on each pipe provides a good verification of temperature readings.</p> <p>3. While in the steaming mode, record the surface temperature of the aluminum jacket material at the location just after the steam generator along the 10” steam pipe, a handheld temperature gun will suffice.</p> <p>4. Obtain any available steam generator temperature or pressure logs for as long as the system has been in operation.</p> <p>5. Obtain the new steam boiler combustion efficiency from the initial installation commissioning test or use a flue gas analyzer to determine the boiler’s efficiency.</p>
<b>Net-to-Gross Review</b>	IOU Proposal: Not provided
	ED Assessment: Not assessed
	ED Recommendation: None