

Phase I Ex Ante Review Findings

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

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| IOU | Pacific Gas & Electric |
| Application ID | 1565-01 & 1565-02 |
| Application Date | 8/26/13 & 11/29/13 |
| Program ID | PGE2223/PGE21027 |
| Program Name | Heavy Industry Energy Efficiency Program |
| Program Year | 2013 |
| Itron Project ID | X438 & X474 |
| IOU Ex Ante Savings Date | 9/26/13 & 12/30/13 |
| CPUC Staff Measure Name | Ring valve upgrade |
| Project Description | Replacing plate valves with ring valves |
| Date of CPUC Staff Review | 1/3/14 |
| Primary Reviewer / Firm | Sepideh Shahinfard / Itron |
| Review Supervisor / Firm | Joseph Ball / 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 | <p>For 1565-01 (X438) the ex ante savings are no longer conditionally approved (provided in CMPA message from CPUC staff on 11/20/2013) and are now not approved pending PG&E continuing ISP research that applies to replacement of plate/ring valves, providing sufficient evidence to support the early retirement claim by including the RUL, age, and condition of both the existing valve and the compressor, valve replacement history and practices followed by the participant, and providing a revised EUL of the proposed valve. Additionally, as a retrofit project, the IOU needs to demonstrate that the measure is not routine maintenance of failing plate valves.</p> <p>This “not-approved” disposition also applies</p> |

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| | to the second EAR sample point (1565-02, X474) that proposes to replace the ammonia side plate valves with ring valves. CPUC staff is unsure why this project was broken into two separate projects and requests an explanation from PG&E or their third party implementer. |
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Measure Description

The project will replace the second and third stage plate valves of a 3500-HP CO₂ reciprocating compressor with ring valves. The claimed energy savings are due to more effective flow area of the ring valves compared to the existing plate valves, which will reduce the pressure drop and reduce energy usage.

The second EAR project (also selected by CPUC staff) proposes to replace the first and second stage plate valves of a 3500-HP NH₃ (ammonia) reciprocating compressor with ring valves.

Summary of Review

The Investor-Owned-Utility (IOU) submitted the following documents on October 17, 2013 for this Phase I review:

- Savings Calculations Workbooks;
- Signed Customer Application Form;
- Pre-installation PCIP Report;
- Facility's Process Flow Diagram; and
- PG&E Energy Statement.

PG&E classified the project as Early Retirement and submitted a dual baseline analysis for the project with the same savings for both first and second baselines. This was concluded based on distribution of valve types in the installed base and not based on the common practices that apply to the similar cases. Therefore, CPUC staff conducted Industry Standard Practice interviews with two major players in the industry [Dresser-Rand and Compressor Product International (CPI) Companies]. "The results of these interviews and a list of questions asked are summarized below:

- What is your experience with Ring valves and Plate Valves?
 - Answer 1: Over 75 years' experience in providing services for compression systems all over the world. We provide ring valves, plate valves, poppet valves, bullet valves, etc.

- Answer 2: Over 18 years in specifying, designing, installations on large 3000-HP systems down to small systems.
- What is your experience with CO2 systems and what is the reason a valve change out would occur?

Answer 1: We have years of experience with CO2 systems, which is the worst type of system as far as required maintenance, because it wears parts at an accelerated rate compared to other systems. The valves wear down faster in CO2 systems but they are not replaced on every scheduled service because they may not have completely worn out yet. **We let the valves wear out prior to replacing them.** A service or maintenance is typically scheduled every nine months or when a service call comes in. The valves need replacing once they've worn down beyond their required thickness. Valves do not last four or five years and the life time is typically shorter. But it all depends on the fluid and the runtime. 24/7 systems wear at a more accelerated rate. Valves are customized specifically for the type of system (fluid, gas, flow, temperature, etc.). There is no one standard design that is used for all systems. **We replace the valve (ring or plate or poppet) with the same part that is currently being used.** We've got no reason to change the valve design during a maintenance or maintenance call.

Typical reason for a valve design change is when we receive a request that a valve is continuously having a maintenance issue or a capacity problem. Then we may perform a design change to recommend the best solution to the customer but it depends on the cause of the problem. We are not automatically replacing plate valves with any new design changes.

Answer 2: Systems have normal failure in short periods of time, within one year or so. A three-year life on a valve operating 24/7 is extraordinary. Valves are customized specifically for the type of system (fluid, gas, flow, temperature, etc.). There is no one standard design that is used. Some fluids are very dirty and wear is accelerated.

- What is considered as the current industry standard practice for these compression systems?

Answer 1: There is no industry standard because repairs come in various forms.

Answer 2: There is no industry standard because repairs come in various forms. It's usually only the simple replacement of parts with the same kind or the use of software to optimize the system and understand the system dynamics if the plate design changes. Radial or Ring valve plates have been around a very long time so there no new standard but rather a smarter more technically accurate analysis available in today's world."

Based on the above interviews, replacing a component of a compressor that is not functioning should use the Normal Replacement baseline. If ring valves have any advantage in reducing the energy use as compared to fully functioning plate valves, incremental savings needs to be demonstrated.

PG&E stated that the expected useful life (EUL) of the existing valve is 15 years which is consistent with many compressed gases measure EULs, and the remaining useful life (RUL) is

five years using the simplified approach. For Early Retirement projects, prior CPUC staff guidance requires PG&E to provide sufficient evidence to support the early retirement claim by including the RUL, age, condition of both the existing valve and the compressor, and valve replacement history and practice. CPUC staff also requests PG&E to revise the EUL of the proposed valve, and must consider the fact that **the EUL of the proposed ring valve will have to be capped by the RUL of the compressor.**

Review Conclusion

The ex ante savings are no longer conditionally approved and **are not approved for either project** pending PG&E continuing ISP research that applies to replacement of plate/ring valves, providing sufficient evidence to support the early retirement claim by including the RUL, age, and condition of both the existing valve and the compressor, and providing a revised EUL of the proposed valve. Additionally, as a retrofit project, the IOU needs to demonstrate that the measure is not a routine replacement of failing plate valves.

The ex ante savings for the second project (1565-02, X474) are also not approved pending the same directives explained in previous paragraph.

Summary of CPUC Staff Requested Action by the IOU

CPUC staff requests that the IOU to undertake the recommended steps and submit the following information - related to both ring valve projects listed in this EAR disposition - **due on 01/20/2013 (or 14 days from submittal date to IOU):**

1. Continue to conduct industry standard practice interviews that apply to replacement of plate valves with ring valves.
2. Demonstrate that this retrofit measure is not a routine/normal replacement.
3. Provide sufficient evidence to support the early retirement claim, including the RUL, vintage (age), existing conditions of both plate valves and the compressor, and valve replacement history and practice followed by the participant.
4. Submit a revised EUL of the proposed measure.
5. Provide the final savings estimates, trued-up to the post-installation measurements;
6. Submit final total project and incremental measure costs supported with detailed, itemized contractor invoices with separate material and labor costs.

Table 1-2 Review Findings

| Reviewed Parameter | Analysis |
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| <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: Early Replacement |
| | CPUC Staff Assessment: Replacing a component of a compressor that is not functioning should use Normal Replacement baseline. For ER projects the IOU must demonstrate that the existing equipment would have continued to function and perform its original design intent for one-third of the EUL but not less than one year in absence of the replacement. |
| | CPUC Staff Recommendation: Provide sufficient evidence to support the early retirement claim by including the RUL, age, condition of both the existing valve and the compressor, and valve replacement history and practice followed by the applicant. |
| <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: Plate valves |
| | CPUC Staff Assessment: Plate valves |
| | CPUC Staff Recommendation: None. Current replacement practice appears to be like-to-like replacement with a plate valve. |
| <p>Project Cost Basis (Full Incremental, or Both. Note: For early retirement projects, include RUL through EUL cost basis treatment)</p> | IOU Proposal: Full cost |
| | CPUC Staff Assessment: Both full measure and incremental measure (2 nd baseline) costs apply |
| | CPUC Staff Recommendation: Provide incremental measure cost |
| <p>RUL (required for early retirement projects only, otherwise N/A)</p> | IOU Proposal: 5 years |
| | CPUC Staff Assessment: For ER projects, sufficient evidence was not provided to support the ER claim. |
| | CPUC Staff Recommendation: Provide sufficient evidence to support RUL claimed of five years including installation dates of both valves and compressor. RUL claim should be supported by including the age, condition of both the existing valve and the compressor, and valve replacement history and practice followed by the applicant. |
| <p>EUL (for each measure)</p> | IOU Proposal: 15 years |
| | CPUC Staff Assessment: Revise the EUL of the proposed valve, considering the fact that the EUL of the proposed ring valve will have to be capped by the RUL of the compressor and industry interviews suggest EUL of less than five years. |
| | CPUC Staff Recommendation: Provide the EUL of the proposed valves, |

| Reviewed Parameter | Analysis |
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| | supported by documented evidence. |
| Savings Assumptions | IOU Proposal: The savings were estimated based on vendor valve efficiency analysis model that calculates the compression horsepower attributed to the accumulative flow loss through the respective valves. Based on the valve specific geometries and pressure drops, the model calculates the pumping power required to overcome the pressure drop across the existing and proposed valves. |
| | CPUC Staff Assessment: The savings calculations based on vendor model are acceptable at this stage. Final savings should be verified based on the post-installation measurements of flow and power. |
| | CPUC Staff Recommendation: Provide the final savings estimates, trued-up to the post-installation measurements |
| Calculation Methods/Tool review | IOU Proposal: Savings were calculated using an engineering spreadsheet and vendor valve efficiency analysis model. |
| | CPUC Staff Assessment: Savings calculation method is acceptable. The baseline may have to be adjusted to a fully functioning plate valve if the ER claim cannot be supported. |
| | CPUC Staff Recommendation: None at this time |
| Pre- or Post-Installation M&V Plan | IOU Proposal: IPMVP Option B with monitoring of the key parameters such as temperature, pressure, power, flow, and on time for both pre- and post-installation. The third party implementer collected existing system operating hours, nameplate data (compressor and motor), and Trend Data (power, pressure, temperature and mass flow) for both CO2 & NH3 systems. |
| | CPUC Staff Assessment: Pre- and post- M&V plan is acceptable, although the duration of monitoring period is not clear. The monitoring period should not be less than one month after the new valve has been stabilized. |
| | CPUC Staff Recommendation: Provide the final savings estimates, trued-up to the post-installation measurements. |
| Net-to-Gross Review | IOU Proposal: Not Provided |
| | CPUC Staff Assessment: An NTG assessment is not warranted at this stage. |
| | CPUC Staff Recommendation: An NTG interview is not recommended |

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

| Description | IOU Ex Ante Claim | CPUC Staff Recommendations |
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| First Year kWh Savings | 504,661 & 358,969 | TBD |
| First Year Peak kW Savings | 75 & 53 | TBD |
| First Year Therms Savings | 0 | TBD |
| kWh Savings (RUL Period) | 504,661 & 358,969 | TBD |
| Peak kW Savings (RUL Period) | 75 & 53 | TBD |
| Therms Impact (RUL Period) | 0 | TBD |
| kWh Savings (RUL thru EUL Period) | 504,661 & 358,969 | TBD |
| Peak kW Savings (RUL thru EUL Period) | 75 & 53 | TBD |
| Therms Savings (RUL thru EUL Period) | 0 | TBD |
| Annual Non-IOU Fuel Impact (RUL Period) | N/A | TBD |
| Annual Non-IOU Fuel Impact (RUL thru EUL Period) | N/A | TBD |
| Project Costs for Baseline #1 (RUL or EUL) | Full Cost: \$150,000 for each project | TBD |
| Project Costs for Baseline #2 (EUL minus RUL period) | Full Cost: \$150,000 for each project | TBD; incremental costs apply if ex ante savings are determined to be valid for the 2 nd baseline. |
| Project Incentive Amount | \$47,853 & \$34,039 | TBD |