

## Phase I Ex Ante Review Findings

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

<b>IOU</b>	PGE
<b>Application ID</b>	1505-01.1
<b>Application Date</b>	9/23/2013 (3P Evaluation Report date)
<b>Program ID</b>	PGE2187
<b>Program Name</b>	2010-2012 3P Monitoring Based Persistence Commissioning Program
<b>Program Year</b>	2013
<b>Itron Project ID</b>	X418
<b>IOU Ex Ante Savings Date</b>	9/23/2013
<b>CPUC Staff Measure Name</b>	MBPCx
<b>Project Description</b>	<p>This RCx project at a school district involves the following measures at six buildings:</p> <p>EEM-3: Reduce operating hours of air conditioning (AC) units and heat pumps,</p> <p>EEM-4: Set cooling tower (CT) fans and condenser water (CW) pumps speed to 0% when the chiller does not operate, and</p> <p>EEM-5: Increase lock out temperature of economizers in AC units and heat pumps.</p> <p>The project also implemented two other measures; EEM-1 - replace existing AC units with high efficiency units, and EEM-2 - replace existing heat pumps with high efficiency heat pumps. However, the IOU technical reviewer found both these measures ineligible for IOU incentives, hence have not been considered as the project scope.</p>
<b>Date of CPUC Staff Review</b>	11/19/2013
<b>Primary Reviewer / Firm</b>	C.D. Nayak/DNV KEMA
<b>Review Supervisor / Firm</b>	Amit Kanungo/DNV KEMA
<b>CPUC Staff Project Manager</b>	██████████ / California Public Utilities Commission, Energy Division

<b>CPUC Staff Policy Authorization (as needed)</b>	
<b>Type of Review (Desk, On-site, Full M&amp;V, Tool)</b>	Desk Review
<b>CPUC Staff Recommendation</b>	Project is conditionally approved. The implementer should revise savings calculation and the measure description as suggested under the section Review Conclusion & Summary of CPUC Staff Requested Action by the IOU.

## Measure Description

This project is proposed at six school sites: one middle school and five elementary schools. Each of these facilities comprises of classroom buildings, multi-purpose rooms, portable buildings, offices, and kitchen. Each school has large number of packaged gas heating/electric cooling rooftop AC units for the main buildings and additional heat pumps for the portable buildings. Only one school has a central plant with a 75 ton water cooled chiller, and a 1,200 MBH natural gas boiler. The chiller plant supplies chilled water to various fan coil units (FCUs) in this school. Each building has its own building automation system, which controls the AC units, chiller, cooling tower, boiler, and FCUs. Most of the AC units have economizers. The classroom operating schedules are from 7 am to 4 pm (Mon-Fri), and office schedules are from 6 am to 5 pm (Mon-Fri). The existing kitchen schedules are from 6 am to 10 pm (Mon-Fri). The middle school has a summer schedule from 6:30 am to 5 pm (Mon-Fri).

The proposed energy efficiency measures for this project involve:

- i) EEM-3: Reducing the operating hours of AC units and heat pumps serving primarily some classrooms, portable buildings, offices, and locker rooms. For the portable buildings, the schedules will be revised from 7 am – 4 pm to 8 am – 4 pm, for the kitchen, the schedule will be revised from 6 am – 10 pm to 6 am – 5 pm, and for office, the schedule will be revised from 6 am – 5 pm to 7 am – 5 pm,
- ii) EEM-4: Shutting off the CT fan and CW pumps when the associated chiller does not operate, and
- iii) EEM-5: Increase economizer lockout temperatures for AC units and heat pumps. The proposed measure will increase the economizer lockout temperatures on AC units from 66 °F to 71° F, and will increase the economizer lockout temperatures on heat pumps from 64 °F to 71 °F.

The project report proposes the following savings:

EEM-3 (Reduce operating hours): 34,901 kWh, and 2,220 therm,

EEM-4 (Shut off CT fans and CW pump): 10,100 kWh, and

EEM-5 (Increase economizer lockout point) 18,286 kWh

The annual cumulative electric consumption during the 2012-13 school year was █████ kWh, and annual gas consumption for the same period was █████ therm. All six schools covered under this application have grid connected solar panels in their campuses and during the summer months from May through September, the surplus powers generated from the solar panels are sent back to the IOU grid. Therefore, the utility electric meter data show negative consumption during these months of the year.

It appears from the project report that the incentive rate for proposed electric savings is \$0.08 per kWh and that for gas savings is \$1.0 per therm. The total claimed incentive is \$7,282.96 and is capped at 50% of the project cost.

### **Summary of Review**

The Investor-Owned-Utility (IOU) submitted (on 10/21/2013) the following documents for this Phase I review:

- Draft pre-installation project report;
- Energy savings and IOU incentive summary;
- Energy savings calculations for individual measures; and
- IOU technical reviewer's pre-installation review report.

IOU submitted (on 10/29/2013) the following additional documents based on CPUC Staff's data request:

- Live spreadsheet calculation for EEM-5;
- Savings calculation for EEM-4; and
- Implementer's clarification of the existing operating hours.

The proposed measures are eligible under the program rules. The proposed savings were estimated with custom spreadsheet calculations. Because the project will also replace the existing AC units and heat pumps with high efficiency units, the savings calculations for EEM-3 through EEM-5 considered the proposed efficiency of the new AC units and heat pumps as baseline along with their existing operating conditions and schedules. CPUC Staff found that the calculation methods and in situ baseline for these system optimization measures selected for savings estimates are appropriate.

The post-RCx M&V will include collecting the EMS information on the new programmed schedule and trending the start/stop times of the rescheduled AC and heat pumps units and for the CT fan and CW pumps. For EEM-5, the project implementer will verify the implementation of new economizer lockout temperatures.

Additionally, CPUC Staff found a few mismatches (listed below) of the reported measure costs and IOU incentive amounts among various project documents, which need to be modified before the project incentive payment can be sent:

- i) Per the project file "1505-01.1 XXXXX USD DE Report Draft\_v3.pdf", the total utility incentive amount as \$5,872, which CPUC Staff found as a typo instead of \$7,282.96.

Another project file, “SummaryTable\_v2.xlsx”, reports no cost for EEM-3 through EEM-5, as well as the statement on measure cost associated with reducing operating hours of AC units and heat pumps (refer Section 1.2 of file “1505-01.1 XXXXX USD DE Report Draft\_v3.pdf”).

- ii) CPUC Staff believes that the final incentive amount for each implemented measure should be capped at 50% of their associated measure costs.
- iii) The project report puts the total measure savings for EEM-4 at 10,100 kWh that will result from shutting down the CT fans and CW pumps when their associated chiller does not operate. However, the savings calculation estimates that the proposed savings will result only from the condenser fan with an estimated final savings of 9,400 kWh.

### **Review Conclusion & Summary of CPUC Staff Requested Action by the IOU**

This project is conditionally approved; pending IOU revision of the savings estimate. The IOU need to revise the following:

1. The project report suggests that the net electric power draw from IOU grid is negative during May through September. Thus, CPUC Staff suggests that the savings calculations (for EEM-3 to EEM-5) be revised and the final savings should not consider the savings resulted during May through September.
2. It appears to CPUC Staff that the savings calculations did not use the correct baseline or proposed operating hours for EEM-3 and need to be revised. While the implementer confirmed that the submitted savings calculations have factored in the summer, winter, and other school vacations and the implementer provided the number of school days for each month, CPUC Staff found that the baseline annual hours used in the submitted calculations are higher than the actual.
3. Further, the savings calculations for EEM-4 and EEM-5 should also be revised to match the revised proposed operating hours used in EEM-3.
4. Lastly, the project report should be revised to correct the measure description for EEM-4 as the proposed savings calculation estimates the savings only from the CW pumps, instead of both CT fan and CW pumps, narrated in the project report.

**Table 1-2 Review Findings**

Reviewed Parameter	Analysis
<p><b>Project Baseline Type</b> (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: Not provided.
	CPUC Staff Assessment: System Optimization. Therefore, existing equipment and conditions are acceptable as the baseline.
	CPUC Staff Recommendation: No change.
<p><b>Project Baseline Technology</b> (in situ equipment, Title 24 (specify year), other code or other efficiency level (specify), industry standard practice - ISP)</p>	IOU Proposal: In situ.
	CPUC Staff Assessment: In situ.
	CPUC Staff Recommendation: No change.
<p><b>Project Cost Basis</b> (Full Incremental, or Both. Note: For early retirement projects, include RUL through EUL cost basis treatment)</p>	IOU Proposal: Full cost.
	CPUC Staff Assessment: Full cost is appropriate for system optimization. The project reports estimates the total project cost as \$11,745 (EEM-3: \$7,540, EEM-4: \$2,320, and \$1,885).
	CPUC Staff Recommendation: Accepted.
<p><b>RUL</b> (required for early retirement projects only, otherwise N/A)</p>	IOU Proposal: N/A
	CPUC Staff Assessment: N/A
	CPUC Staff Recommendation: N/A
<p><b>EUL</b> (for each measure)</p>	IOU Proposal: EEM-3: 3 years, EEM-4: 3 years, and EEM-5: 3 years
	CPUC Staff Assessment: The EUL information given with the project documents is appropriate per PG&E’s RCx project submittal guidelines, Version 1.2, November 15, 2010.
	CPUC Staff Recommendation: Accepted
<p><b>Savings Assumptions</b></p>	<p>IOU Proposal: The following assumptions have been made in the submitted savings calculations:</p> <p>EEM-3: The savings calculations are based on the proposed efficiencies of the new AC units and heat pumps as their baseline. The average building</p>

Reviewed Parameter	Analysis
	<p>return air temperature is assumed at 72 °F, and economizer minimum open position at 20%. The supply air temperature is assumed to vary between 47 °F and 86 °F. The economizers are assumed to remain at 100% open position during OAT at 65 °F to 70 °F.</p> <p>EEM-4: The savings estimation assumed that the chiller is in operation for OAT greater than 68 °F. However, as the claimed savings calculation was prepared with a 5 °F BIN interval, the claimed savings were pump energy during OAT less than 70 °F.</p> <p>CPUC Staff Assessment: CPUC Staff verified the assumptions made in the submitted savings calculation, and found them reasonable. It appears that the input used for these savings estimation, such as motor power, AC design flow rates, and motor efficiencies were collected from their nameplates. The savings estimated is limited only to OAT condition between 65 °F to 70 °F, and therefore, the proposed electric savings for each AC or heat pump unit is very insignificant.</p> <p>CPUC Staff Recommendation: No change.</p>
<p><b>Calculation Methods/Tool review</b></p>	<p>IOU Proposal: The claimed savings were estimated with custom spreadsheet BIN calculations.</p> <p>EEM-3: The claimed savings are estimated based on custom spreadsheet calculations. The claimed savings consists of both electric and heating savings, and the electric fan motor savings result from the reduced operating hours of the AC unit fans.</p> <p>EEM-4: The savings estimated for the reduced CW pump hours was done with a custom BIN calculation. The savings were estimated for those hours in the post case when OAT is less than 70 °F. No savings calculation was provided for the savings from CT fans.</p> <p>EEM-5: The savings calculation assumed that the OA damper will remain 100% open when the OAT between 65 °F to 70 °F, and for the remaining period the OA damper will remain at minimum open position (20%).</p> <p>CPUC Staff Assessment: The calculations developed for the proposed savings appear to have adopted a reasonable approach. CPUC Staff made following observations:</p> <p>EEM-3: From the annual operating hours used the baseline models, it is not clear to CPUC Staff if the submitted calculations have considered the school vacations during summer and winter. CPUC Staff observed that EEM-3 calculation has utilized the weather file for CZ03 while the project site is located at CZ04.</p> <p>EEM-4: CPUC Staff found the calculation used for the CW pumps savings appropriate. Further, it found that while the measure description in the project report talks about shutting down both CT fans and CW pumps, the savings calculation confirms that the total savings will result only from the CW pumps.</p>

Reviewed Parameter	Analysis
	<p>EEM-5: The proposed savings are calculated with custom spreadsheet BIN calculations. The proposed conditions of EEM-5 are used as the baseline for EEM-3.</p> <p>CPUC Staff Recommendation: The project report suggests that the net electric power draw from IOU grid is negative during May through September. Thus, CPUC Staff suggests that the savings calculations (for EEM-3 to EEM-5) be revised and the final savings should not consider the savings resulted during May through September.</p> <p>CPUC Staff found that the annual operating hours used in the savings calculation do not match with the information provided by the implementer on the total number of school days for each months and the existing HVAC operation schedule. While the implementer confirmed CPUC Staff's query that the submitted calculations have factored the winter and summer vacations, CPUC Staff found it otherwise. The implementer should revise the savings calculations (EEM-3 through EEM-5) to stay consistent with the pre-MBCx annual operating hours.</p>
<p><b>Pre- or Post-Installation M&amp;V Plan</b></p>	<p>IOU Proposal: It appears from the project documents that the existing operating conditions and schedules were considered for the submitted savings estimation, and no pre-installation M&amp;V was done for this project. The project report spells out the following M&amp;V approach for the post phase:</p> <p>EEM-3: The implementer plans to conduct a post-installation M&amp;V and to collect the EMS screenshot to verify the post-case AC units and heat pumps schedules.</p> <p>EEM-4: The implementer plan to verify that the CT fan and CW pumps shut down when the chiller is not in operation and the OAT setpoints for CT and CW pumps operations.</p> <p>EEM-5: The implementer plans to verify the economizer lockout setpoints for AC units and heat pumps.</p> <p>Finally, in order to ensure the persistence of the proposed measure, the implementer plans to monitor the system operations semi-annually for one year after their implementation.</p> <p>CPUC Staff Assessment: CPUC Staff considers the proposed post-installation M&amp;V strategy adequate.</p> <p>However, The project implementer should collect 4 weeks of trends for the AC units and heat pumps start/stop times, the ON/OFF status of the CT fan and CW pump along with the associated chiller status. The trend period should coincide, to a reasonable extent, with the OAT range the project site sees throughout a year. Further, the implementer should select few representative AC/heat pump economizers and collect their EMS information regarding lockout temperatures and trend their OA damper position along with OAT for at least 4 weeks to verify the implementation of EEM-5.</p> <p>CPUC Staff Recommendation: No change.</p>

Reviewed Parameter	Analysis
Net-to-Gross Review	IOU Proposal: TBD
	CPUC Staff Assessment: TBD
	CPUC Staff Recommendation: TBD

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

Description	IOU Ex Ante Claim	CPUC Staff Recommendations
<b>First Year kWh Savings</b>	62,287 kWh EEM-3: 34,901 kWh EEM-4: 10,100 kWh EEM-5: 18,286 kWh	TBD
<b>First Year Peak kW Savings</b>	N/A	N/A
<b>First Year Therms Savings</b>	2,220 therm EEM-3: 2,220 therm EEM-4: 0 EEM-5: 0	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
<b>kWh Savings (RUL thru EUL Period)</b>	62,287 kWh EEM-3: 34,901 kWh EEM-4: 10,100 kWh EEM-5: 18,286 kWh	TBD
<b>Peak kW Savings (RUL thru EUL Period)</b>	N/A	N/A
<b>Therms Savings (RUL thru EUL Period)</b>	2,220 therm EEM-3: 2,220 therm EEM-4: 0 EEM-5: 0	TBD
<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>Project Costs for Baseline #1 (RUL or EUL)</b>	Full costs - \$11,745 EEM-3 - \$7,540 EEM-4 - \$2,320 EEM-5 - \$1,885	TBD

*Phase I Ex Ante Review Findings*

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<b>Description</b>	<b>IOU Ex Ante Claim</b>	<b>CPUC Staff Recommendations</b>
<b>Project Costs for Baseline #2</b> (EUL minus RUL period)	N/A	N/A
<b>Project Incentive Amount</b>	\$7,282.96 EEM-3: \$5,012.08 EEM-4: \$808 EEM-5 - \$1,462.88	TBD