

## **Ex Ante Prospective Review Findings**

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

<b>IOU</b>	Pacific Gas and Electric
<b>Application ID</b>	2K12082172
<b>Application Date</b>	2/29/2012
<b>Program ID</b>	TBD
<b>Program Name</b>	Non Residential Retrofit Program
<b>Program Year</b>	2012
<b>Itron Project ID</b>	X103
<b>IOU Ex Ante Savings Date</b>	TBD
<b>ED Measure Name</b>	HVAC & Controls Upgrade
<b>Project Description</b>	This customized retrofit project at a office building includes the following measures: Replace existing box car units with high efficiency units, reset supply air temperature (SAT), static pressure, and heating hot water (HHW) supply temperature; optimize start/stop controls, install CO <sub>2</sub> based demand control ventilation, convert to variable volume HHW flow, and upgrade lighting.
<b>Date of ED Review(s)</b>	05/08/2012 & 7/5/2012
<b>Primary Reviewer and Firm</b>	C.D. Nayak/DNV KEMA
<b>Review Supervisor and Firm</b>	Kunal Desai/Itron
<b>Type of Review (Desk, On-site, Full M&amp;V, Tool)</b>	Desk review
<b>ED Recommendation</b>	The supporting documents provided were insufficient to substantiate the energy savings estimate of this project. Additional data are required to complete this prospective review.

**Measure Description**

This project is located at five office buildings (2025, 2027, 2029, 2051 and 2061) in XXXXXXXX, and was carried as part of PG&E’s Large Integrated Audit program. The buildings were constructed between 1988 and 1992. The following energy efficiency measures were involved:

- 1. EEM-1: Upgrade to Premium Efficiency Package Units - Most of the units are original, installed in the late 80’s to early 90’s, and have reached the end of their useful life. The new premium efficiency units have efficiency ratings 10.2 EER.
- 2. EEM-2: Hot Water Pump Variable Speed Drives - Converting the existing constant volume hot water system in building 2025, 2027, 2029, and 2061 to variable flow system with VFDs on the pumps.
- 3. EEM-3: Supply Air Temp/Static Pressure Reset - Buildings 2025, 2027 and 2029 are pneumatically controlled and do not currently have SAT and static pressure reset control capability. Installed DDC controls in these building to implement the control measures.
- 4. EEM-4: Hot Water Temperature Reset - Buildings 2025, 2027 and 2029 do not currently have HHW temperature reset control capability. Installed DDC controls in these buildings to implement this control measure.
- 5. EEM-5: Optimum Start/Stop Controls - Buildings 2025, 2027 and 2029 do not currently have this control capability. Installed DDC in these buildings to implement optimum start/stop based on the building schedule, and start/stop heating and cooling control measures.
- 6. EEM-6: Demand Control Ventilation - The potential energy savings for this measure were estimated using PG&E’s CRI software.
- 7. EEM-7: Advanced Lighting Upgrades - The current lighting efficiency is approximately 0.75 Watts/sqft, and fitted with T8s, T5s and compact fluorescents. With enhanced controls and dimmable ballast, the facility is to reduce the lighting loads on average to 0.50 - 0.35 Watts/sqft.

Formatted: Bulleted + Level: 1 + Aligned at: 0.25" + Indent at: 0.5", Tab stops: Not at 0.5"

The following table is a summary of the measures to be implemented by building.

EEM/Bldg	EEM-1	EEM-2	EEM-3	EEM-4	EEM-5	EEM-6	EEM-7
Bldg-1 (2029)	X	X	X	X	X	X	X
Bldg-2 (2027)	X	X	X	X	X	X	X
Bldg-3 (2025)	X	X	X	X	X	X	X
Bldg-4 (2051)	X					X	X
Bldg-5 (2061)	X	X				X	X

**Summary of Review**

The documents provided for ED review include the following: project application form, monthly gas consumption data, PG&E’s large integrated audit program – preliminary technical assessment guide, preliminary energy savings summary, detailed description of the proposed

measures, project timelines, eQUEST files, savings summary based on individual measures, and e-mail correspondences.

The incentive application does not contain the claimed saving numbers. The submitted project files contain two energy savings summary and both have claimed different final savings. The first energy savings summary document (██████████ Preliminary Savings (031312).xlsx) has put the final savings as: 927,047.2 kWh/yr, 250.15 kW, and 9,236 therm/yr. The second energy savings summary document (██████████ results-Preliminary.xlsx) has put the final savings as: 1,349,156 kWh/yr, 342.6 kW, and 3,658 therm/yr. The project claims an incentive of \$103,239.47 per the first summary document, and \$146,205.52 per the second summary document. Therefore, ED could not verify the final project savings and incentive amount.

The gas savings incentive was calculated at \$1.00/therm, the lighting upgrade incentive was calculated at \$0.05/kWh, the DX unit upgrade incentive was calculated at \$0.15/kWh, and the rest of the electric savings incentive was calculated at \$0.09/kWh.

Energy saving calculation for the proposed measures was estimated with separate eQUEST models for each building. From the submitted document (D-Large Integrated Audit Cover Sheet.doc), it appears that there are three electric meters and two gas meters for this facility, though only one annual gas usage information is available (30,731 therm/yr). None of the electric meter annual usage information is available with the submitted documents. However, it is not clear to ED as how the individual meters are connected to these electric and gas meters. Therefore, ED could not verify if the submitted eQUEST models are correctly calibrated with the actual site usage.

The submitted project scope mentions that the existing DX units are at the end of their useful service life. However, it does not provide any information on the EUL of other equipment. In the absence of adequate information, ED could not verify the nature of this retrofit project. Therefore, only EEM-1 is considered as the normal replacement measure, and the remaining measures (EEM-2 to EEM-7) were considered as early replacement.

#### Review Summary for Building 1 (Building 2029)

The building supply fan has a VFD, the economizer is controlled with a fixed fraction at OAT higher than 70 F, and the cooling and heating supply temperatures are set at 55 F and 120 F respectively. But there are triangulation issues with the model as poly lines are crisscrossing each other. This should be corrected although it does not impact simulation of the model. There is not adequate information on the building description, HVAC system, and heating and cooling arrangement.

EEM-1: Upgrade to Premium Efficiency Package Units - The modeled EIR value for the proposed unit is correct. The proposed EER value of the DX units is modeled correctly (10.2 EER = 2.9894 COP = 0.3345 EIR). The proposed DX unit has efficiency higher than Title 24

minimum suggested efficiency (9.7 EER, IPLV) for air cooled unitary air conditioner and condensing unit for capacity less than 760,000 btu/hr (Table 112-A, 2008 Title 24). Furthermore, the baseline model has considered the existing DX unit efficiency (EER = 9.32). However, as this proposed EEM is taken as a normal replacement, Title 24 suggested minimum efficiency should be considered in the baseline model.

EEM-2: Hot Water Pump Variable Speed Drives - The model does not have VFDs on the hot water pumps. There is no connection of the pumps to the boilers or space heating equipment.

EEM-3: Supply Air Temp/Static Pressure Reset - The model does not have static pressure reset controls in the parametric runs.

EEM-4: Hot Water Temperature Reset - The parametric runs do not model HW temperature reset controls on these buildings. Also this is questionable as there is no space heating equipment nor any gas based component associated with the results of the simulation.

EEM-5: Optimum Start/Stop Controls – The optimum control is based on the temperature.

EEM-6: Demand Control Ventilation – There are no separate CRI tool output available to ED to verify the Demand Control ventilation savings. However, ED recommends that the savings should be calculated as integrated into the eQUEST model.

EEM-7: Advanced Lighting Upgrades - Lighting also can be integrated into the eQUEST model. If it is done outside of eQUEST, an explanation of interactive effects of the lighting on HVAC should be discussed and evaluated on the baseline and subsequent parametric runs.

#### Review Summary for Building 2 (Building 2027)

The building supply fan has a VFD, the economizer control is with OAT and high limit on 70 F, and the cooling and heating supply temperatures are set at 55 F and 120 F respectively. There is not adequate information on the building description, HVAC system, and heating and cooling arrangement.

EEM-1: Upgrade to Premium Efficiency Package Units - The modeled EIR value for the proposed unit is correct. The proposed EER value of the DX units is modeled correctly (10.2 EER = 2.9894 COP = 0.3345 EIR). The proposed DX unit has efficiency higher than Title 24 minimum suggested efficiency (9.7 EER, IPLV) for air cooled unitary air conditioner and condensing unit for capacity less than 760,000 btu/hr (Table 112-A, 2008 Title 24). Furthermore, the baseline model has considered the existing DX unit efficiency (EER = 9.32). However, as this proposed EEM is taken as a normal replacement, Title 24 suggested minimum efficiency should be considered in the baseline model. EEM-2: Hot Water Pump Variable Speed Drives - The model does not a HHW loop, rather the building space heating is done with a furnace.

EEM-3: Supply Air Temp/Static Pressure Reset - The model does not have supply air temperature and static pressure reset controls in the parametric runs.

EEM-4: Hot Water Temperature Reset – The model does not have HHW reset in the parametric runs as the model does not have any HHW loop.

EEM-5: Optimum Start/Stop Controls – The optimum control is based on the temperature for both morning and night operation control.

EEM-6: Demand Control Ventilation – There are no separate CRI tool output available to ED to verify the Demand Control ventilation savings. However, ED recommends that the savings should be calculated as integrated into the eQUEST model.

EEM-7: Advanced Lighting Upgrades - Lighting also can be integrated into the eQUEST model. If it is done outside of eQUEST, an explanation of interactive effects of the lighting on HVAC should be discussed and evaluated on the baseline and subsequent parametric runs.

Review Summary for Building 3 (Building 2025)

The building supply fan has a VFD, the economizer is control with a fixed fraction at OAT higher than 70 F, and the cooling and heating supply temperatures are set at 55 F and 120 F respectively. There is not adequate information on the building description, HVAC system, and heating and cooling arrangement.

EEM-1: Upgrade to Premium Efficiency Package Units - The modeled EIR value for the proposed unit is correct. The proposed EER value of the DX units is modeled correctly (10.2 EER = 2.9894 COP = 0.3345 EIR). The proposed DX unit has efficiency higher than Title 24 minimum suggested efficiency (9.7 EER, IPLV) for air cooled unitary air conditioner and condensing unit for capacity less than 760,000 btu/hr (Table 112-A, 2008 Title 24). Furthermore, the baseline model has considered the existing DX unit efficiency (EER = 9.32). However, as this proposed EEM is taken as a normal replacement, Title 24 suggested minimum efficiency should be considered in the baseline model.

EEM-2: Hot Water Pump Variable Speed Drives - The model does not have VFDs on the hot water pumps. There is no connection of the pumps to the boilers or space heating equipment.

EEM-3: Supply Air Temp/Static Pressure Reset - The model does not have static pressure reset controls in the parametric runs.

EEM-4: Hot Water Temperature Reset - The parametric runs do not model HW temperature reset controls on these buildings. Also this is questionable as there is no space heating equipment nor any gas based component associated with the results of the simulation.

EEM-5: Optimum Start/Stop Controls – The optimum control is based on the temperature.

EEM-6: Demand Control Ventilation – There are no separate CRI tool output available to ED to verify the Demand Control ventilation savings. However, ED recommends that the savings should be calculated as integrated into the eQUEST model.

EEM-7: Advanced Lighting Upgrades - Lighting also can be integrated into the eQUEST model. If it is done outside of eQUEST, an explanation of interactive effects of the lighting on HVAC should be discussed and evaluated on the baseline and subsequent parametric runs.

Review Summary for Building 4 (Building 2051)

The building supply fan has a VFD, the economizer control is with OAT and high limit on 70 F, and the cooling and heating supply temperatures are set at 55 F and 120 F respectively. There is not adequate information on the building description, HVAC system, and heating and cooling arrangement.

EEM-1: Upgrade to Premium Efficiency Package Units - The modeled EIR value for the proposed unit is correct. The baseline EER value of the DX units is modeled correctly (10.2 EER = 2.9894 COP = 0.3345 EIR). The proposed DX unit has efficiency higher than Title 24 minimum suggested efficiency (9.7 EER, IPLV) for air cooled unitary air conditioner and condensing unit for capacity less than 760,000 btu/hr (Table 112-A, 2008 Title 24). Furthermore, the baseline model has considered the existing DX unit efficiency (EER = 9.32). However, as this proposed EEM is taken as a normal replacement, Title 24 suggested minimum efficiency should be considered in the baseline model.

EEM-6: Demand Control Ventilation – There are no separate CRI tool output available to ED to verify the Demand Control ventilation savings. However, ED recommends that the savings should be calculated as integrated into the eQUEST model.

EEM-7: Advanced Lighting Upgrades - Lighting also can be integrated into the eQUEST model. If it is done outside of eQUEST, an explanation of interactive effects of the lighting on HVAC should be discussed and evaluated on the baseline and subsequent parametric runs.

Review Summary for Building 5 (Building 2061)

The building supply fan has a VFD, the economizer control is with OAT and high limit on 70 F, and the cooling and heating supply temperatures are set at 55 F and 120 F respectively. But there are triangulation issues with the model poly lines crisscrossing each other. This should be corrected although it does not impact simulation of the model. There is not adequate information on the building description, HVAC system, and heating and cooling arrangement.

EEM-1: Upgrade to Premium Efficiency Package Units - The modeled EIR value for the proposed unit is correct. The baseline EER value of the DX units is modeled correctly (10.2 EER = 2.9894 COP = 0.3345 EIR). The proposed DX unit has efficiency higher than Title 24 minimum suggested efficiency (9.7 EER, IPLV) for air cooled unitary air conditioner and condensing unit for capacity less than 760,000 btu/hr (Table 112-A, 2008 Title 24). Furthermore, the baseline model has considered the existing DX unit efficiency (EER = 9.32). However, as this proposed EEM is taken as a normal replacement, Title 24 suggested minimum efficiency should be considered in the baseline model.

EEM-2: Hot Water Pump Variable Speed Drives - The model does not have HHW loop, and the building heating is modeled to be done with a furnace. There is no connection of the pumps to the boilers or space heating equipment.

EEM-6: Demand Control Ventilation – There are no separate CRI tool output available to ED to verify the Demand Control ventilation savings. However, ED recommends that the savings should be calculated as integrated into the eQUEST model.

EEM-7: Advanced Lighting Upgrades - Lighting also can be integrated into the eQUEST model. If it is done outside of eQUEST, an explanation of interactive effects of the lighting on HVAC should be discussed and evaluated on the baseline and subsequent parametric runs.

Additional documentation will be needed to evaluate the appropriateness of the methodology used to calculate energy savings and complete the ex-ante review for this project.

### **Review Conclusion**

The supporting documents provided were insufficient to substantiate the energy savings estimate of this project, pending fulfillment of requested data and subsequent opportunity for ED to re-evaluate the project and the savings analyses.

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

The supporting documents provided were insufficient to substantiate the energy savings estimate of this project. So, ED requests that the IOU submit the following additional data for the completion of the ex-ante prospective review of this project:

1. Provide detail description of the building, building cooling load nature, mechanical/equipment schedule (for verifying HVAC system and cooling and heating parameters/setpoints/control sequence/logic). Provide the pre-installation inspection findings to establish the existing condition.
2. Provide the energy savings calculations (developed with CRI software) for EEM-6 (Demand Control Ventilation) for each of the building sites. However, ED feels that as the CRI software has some issues in determining the DCV measure savings satisfactorily, and at the same time the measure savings can be calculated with the building eQUEST models adequately, therefore, the submitted eQUEST models may be revised to include EEM-6. Additionally, the baseline model has lower EER than Title-24 standard, so the eQUEST baseline models should be re-simulated using Title-24 baseline EER.
3. As ED is not sure regarding the calibration of the submitted eQUEST models, additional information may be required on the individual building monthly electric and gas usages and building models calibration details.

**Formatted:** Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.19" + Indent at: 0.44", Tab stops: Not at 0.5"

*Ex Ante Review Findings*

4. Provide the revised eQUEST models after resolving the triangulation issues, incorporating all proposed measures as parametric runs.
5. Provide existing equipment nameplate information, control strategy, operating hours and all other relevant parameters used in the model
6. Provide all project cost quotes/cost estimates/invoices
7. Provide EUL of the measure and source of the EUL

**Table 1-2: 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>	Appears to be normal replacement for the DX units and Early replacement for other add-on measures	TBD; Provide additional document on exiting equipment to establish the baseline
<b>Project Cost Basis (Full Cost, Incremental Cost)</b>	Full cost - \$1,967,146.00 per the first summary document, and \$2,156,123.00 per the second summary document.	TBD; Not clear from the available project documents. Need to provide incremental cost for normal replacement measure and full cost for early replacement measure
<b>RUL (Early retirement projects only, otherwise N/A (not applicable))</b>	Not provided	If early replacement claim is applicable for EEM-2 to EEM 7 then additional information needed on the age, condition and RUL of the existing equipment to validate baseline selection
<b>EUL</b>	Not provided	Per DEER 2008, 15 years for VFD installation on pumps, 15 years for new commercial air conditioners, and 15 years for energy management system controls.

*Ex Ante Review Findings*

<b>Description</b>	<b>IOU Proposed Ex Ante Data</b>	<b>ED Recommendations</b>
<b>First Year kWh Savings</b>	Not clear from the available documents.	TBD
<b>First Year Peak kW Savings</b>	Not clear from the available documents	TBD
<b>First Year Therms Savings</b>	Not clear from the available documents	TBD
<b>kWh Savings (RUL Period)</b>	TBD	TBD
<b>Peak kW Savings (RUL Period)</b>	TBD	TBD
<b>Therms Impact (RUL Period)</b>	N/A	N/A
<b>kWh Savings (EUL thru RUL Period)</b>	Not clear from the available documents	TBD
<b>Peak kW Savings (EUL thru RUL Period)</b>	Not clear from the available documents	TBD
<b>Therms Savings (EUL thru RUL Period)</b>	Not clear from the available documents	TBD
<b>Annual Non-IOU Fuel Impact (RUL Period)</b>	N/A	N/A
<b>Annual Non-IOU Fuel Impact (EUL thru RUL Period)</b>	N/A	N/A
<b>Net-to-Gross Ratio</b>	Not provided	Assessment not completed

**Table 1-3: Detailed Review Findings**

Reviewed Parameter	Analysis
<b>Project Gross Savings Baseline</b> (for early retirement projects only, include RUL through EUL baseline)	IOU Proposal: Appears to be normal replacement for the DX units and Early replacement for other add-on measures
	ED Assessment: It appears from the available documents that EEM-1 is treated as a normal replacement measure. However, it is not clear for the other EEMs.
	ED Recommendation: Further documentation needed to establish the baselines for all the measures
<b>Project Cost Basis</b> (for early retirement projects only, include RUL through EUL cost basis treatment)	IOU Proposal: Appears to be full cost
	ED Assessment: Could not be assessed because application documents and itemized quotes were not provided
	ED recommendation: Provide incremental cost for the normal replacement baseline measure and full cost for early replacement measures
<b>RUL</b> (required for early retirement projects only, otherwise n/a)	IOU Proposal: Not provided
	ED Assessment: EEM 2 to EEM 7 appear to be early replacement claims.
	ED recommendation: If early replacement claim is applicable for EEM-2 to EEM 7 then additional information needed on the age, condition and RUL of the existing equipment to validate baseline selection
<b>EUL</b>	IOU Proposal: Not provided
	ED Assessment: Consult DEER 2008 for EULs
	ED Recommendation: Per DEER 2008, 15 years for VFD installation on pumps, 15 years for new commercial air conditioners, 15 years for energy management system controls.
<b>Savings Assumptions</b>	IOU Proposal: Energy saving calculations for the proposed measures were estimated with separate eQUEST models for each building.
	ED Assessment: It is not clear to ED if the input parameters used in the submitted eQUEST models are based on the pre-installation inspection findings/design values from mechanical schedule/engineering assumptions.
	ED Recommendation: Provide additional documents, such as, mechanical schedules, pre-installation inspection findings, and the list of assumptions

*Ex Ante Review Findings*

Reviewed Parameter	Analysis
	made in building the eQUEST models.
<b>Calculation Methods/Tool review</b>	IOU Proposal: Energy saving calculation for the proposed measures were estimated with separate eQUEST models for each building. Parametric runs were created for each proposed measure. The submitted document suggests that the claimed savings for the proposed DCV (EEM-6) were calculated with separate CRI savings calculation tool.
	ED Assessment: Not all proposed measures are correctly included as parametric runs in the submitted eQUEST models. Furthermore, there are two separate sets of claimed energy savings summary. The submitted documents do not include the CRI software tool output for EEM-6 claimed savings. Lastly, it is not clear from the submitted files if the proposed lighting upgraded measures were calculated separately with any custom spreadsheet calculation. However, ED feels that both EEM-6 and EEM-7 should be included in the submitted eQUEST models. It appears that the developed models are not calibrated with building utility data, and neither do the models describe the building systems completely.
	ED Recommendation: Provide additional documents on EEM-6 and EEM-7 claimed savings calculation. Otherwise, all proposed EEMs should be included in the submitted eQUEST files and to be revised with all suggested changes in the building models.
<b>Pre- or Post-Installation M&amp;V Plan</b>	IOU Proposal: No M&V plan was provided
	ED Assessment: It appears that no baseline M&V was done, and no post-retrofit plan is provided either. It further appears that the baseline conditions are taken from the pre-installation inspection findings. However, no such information/documents are available.
	ED Recommendation: ED suggests that both pre-installation and post-installation inspection findings are to be provided. Pre-installation inspection findings are required to verify the baseline conditions, while the post-retrofit inspection findings are needed after the completion of the project. M&V plan should be submitted as required by the program rules.
<b>Net-to-Gross Review</b>	IOU Proposal: Not provided
	ED Assessment: A NTG assessment may be warranted
	ED Recommendation: A NTG interview is recommended

**Formatted:** Indent: Left: -0.25", Bulleted + Level: 1 + Aligned at: 0.25" + Indent at: 0.5", Tab stops: Not at 0.5"