

Pacific Gas and Electric Company Customized Retrofit - Demand Response Installation Review

Tech Reviewer: kW Engineering
Reviewer Name: Curtis Lee

Revision: 0
Administrator: Eva Chu

Project #: 2K10039225
Project Name: Chiller Replacement Project
Site Address: 1400 Fifth Street
San Rafael, CA 94901
Sponsor: City of San Rafael
Customer: City of San Rafael
Approach: Customized Retrofit

Review Dates
Sent to TR: 7/16/2013
Inspected: 7/30/2013
Review completed by TR: 8/13/2013
QC'd by: Bruce Douglas

Application Status: Approved Suspended Declined

Summary of Installation Review Results

Savings Estimates	CR Savings			DR Savings	Total Capital Costs
	kWh	kW	Therms	Dispatch Demand	
Application Approved Amount	60,937.4	16.80	0.0	0.00	\$ 144,830.00
Installation Submitted Amount	60,937.4	16.80	0.0	0.00	\$ 144,830.00
Installation Approved Amount	68,291.9	20.19	0.0	0.00	\$ 788,000.00

Incentive Estimates	Gross Incentive(\$)	Project Cost Adj.	Other Adj.	Net Incentive
Application Approved Amount	\$ 10,820.61	\$ -	\$ -	\$ 10,820.61
Installation Submitted Amount	\$ 10,820.61	\$ -	\$ -	\$ 10,820.61
CR Installation Approved Amount	\$ 12,262.79	\$ -	\$ 1,442.18	\$ 10,820.61
DR Installation Approved Amount*	\$ -	\$ -	\$ -	\$ -

Updated incentive exceeded contract amount and has been reduced to the contract amount.

**Incentive adjusted based on project cost, site, and/or customer cap. See CR-DR Terms and Conditions for details.

Comments

Project Description

This project replaced a 100-ton, water-cooled, reciprocating chiller with a 76-ton air-cooled chiller and converted two air handler units (AHUs) to variable flow units at the City Hall building at 1400 Fifth Street in San Rafael, California. The installed air-cooled chiller consumes less energy than the water-cooled unit and does not have a cooling tower or condenser water pump. The AHU retrofit saves fan energy by reducing the input power to the supply and return fans during periods when the building demands less conditioning air flow. Replacing the constant air volume (CAV) terminal boxes with variable air volume (VAV) boxes on the first floor of the building enables reduced air flow rates. In addition, the new AHUs have allowed for the removal of an outside air supply fan, which served the first floor. The energy savings were determined from engineering calculations.

Review Summary

The Installation Review (IR) is approved at a DEER Peak demand reduction (IR) of 20.19 kW and energy savings of 68,291.9 kWh, which is more than the 16.80 kW and 60,937.4 kWh submitted for the IR. The baseline energy usage of the equipment involved in this project represents 22.2% of the total site electric usage for the last twelve months of utility billing data for the site supplied for this review by PG&E. The energy savings resulting from the measures involved in this project represent 44.8% of the baseline energy usage of the equipment involved and does not exceed the twelve months of utility billing data.

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Pacific Gas and Electric Company Customized Retrofit - Demand Response Installation Review Comments

Project #: 2K10039225
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Administrator: Eva Chu
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Comments

Review Summary (cont)

The corresponding approved incentive is \$10,820.61 which is equivalent to the IR submitted incentive amount. Although there is an increase in energy savings, based on the 2010 PG&E Statewide Customized Offering Procedures Manual for Business (SCOPMB) Section 1.8.1, the incentive amount may exceed the contracted amount if the measure costs increased, more efficient equipment is installed, or more units of the same measure are installed. Since the energy savings increased due to a smaller motor being installed, the additional energy savings are not eligible for incentive. Invoices were provided by the Project Sponsor during the post-installation inspection. The approved cost does not result in a 50% measure cost cap adjustment (see Measure Costs section).

Table 1: PA Approved Amounts, IR Submitted and IR Approved

Project Application Approved Amounts															
Measure ID	Measure Description	Old Measure Code	New Measure Code	Incentive Rates			Savings			Incentives		Measure Cost	Measure Cost Adj.	Total Incentive	Comments
				Demand (\$/kW)	Energy (\$/kWh)	Energy (\$/therm)	Demand (kW)	Energy (kWh)	Energy (therms)	Demand	Energy Savings				
1	Replace Chiller	S311	CHC11	\$100.00	\$0.15	\$1.00	0.00	26,666.4	0.0	\$0.00	\$3,999.96	\$55,500.00	\$0.00	\$3,999.96	Adjusted measure cost.
2	Replace AHU and Terminal Boxes	S315	CHA31	\$100.00	\$0.15	\$1.00	16.80	34,271.0	0.0	\$1,680.00	\$5,140.65	\$89,330.00	\$0.00	\$6,820.65	
Total							16.80	60,937.4	0.0	\$1,680.00	\$9,140.61	\$144,830.00	\$0.00	\$10,820.61	

Installation Review Submitted Amounts															
Measure ID	Measure Description	Old Measure Code	New Measure Code	Incentive Rates			Savings			Incentives		Measure Cost	Measure Cost Adj.	Total Incentive	Comments
				Demand (\$/kW)	Energy (\$/kWh)	Energy (\$/therm)	Demand (kW)	Energy (kWh)	Energy (therms)	Demand	Energy Savings				
1	Replace Chiller	S311	CHC11	\$100.00	\$0.15	\$0.00	0.00	26,666.4	0.0	\$0.00	\$3,999.96	\$291,293.05	\$0.00	\$3,999.96	Adjusted measure cost.
2	Replace AHU and Terminal Boxes	S315	CHA31	\$100.00	\$0.15	\$0.00	16.80	34,271.0	0.0	\$1,680.00	\$5,140.65	\$496,706.95	\$0.00	\$6,820.65	
Total							16.80	60,937.4	0.0	\$1,680.00	\$9,140.61	\$788,000.00	\$0.00	\$10,820.61	

Installation Review Submitted Amounts															
Measure ID	Measure Description	Old Measure Code	New Measure Code	Incentive Rates			Savings			Incentives		Measure Cost	Measure Cost Adj.	Total Incentive	Comments
				Demand (\$/kW)	Energy (\$/kWh)	Energy (\$/therm)	Demand (kW)	Energy (kWh)	Energy (therms)	Demand	Energy Savings				
1	Replace Chiller	S311	CHC11	\$100.00	\$0.15	\$0.00	0.00	31,034.6	0.00	\$0.00	\$4,655.19	\$291,293.05	\$655.23	\$3,999.96	IR incentive capped at
2	Replace AHU and Terminal Boxes	S315	CHA31	\$100.00	\$0.15	\$0.00	20.19	37,257.3	0.00	\$2,019.00	\$5,588.60	\$496,706.95	\$786.95	\$6,820.65	PA amount
Total							20.19	68,291.9	0.00	\$2,019.00	\$10,243.79	\$788,000.00	\$1,442.18	\$10,820.61	

Energy Savings Verification

Cindy Wu of kW Engineering met Larry Sisseck, Jim Forsythe, and Jeff Stutsman at the City Hall Building in San Rafael, California on July 30, 2013 to conduct the post-installation inspection.

Based on the post-installation inspection findings, the following change was made to the PA approved calculations:

- Adjusted the return fan motor size on AHU-1 from 10.0-hp to 5.0-hp.

The DEER Peak demand period for San Rafael, California (Climate Zone 2) occurs between the hours of 2:00 PM to 5:00 PM between July 22 and July 24. Since the VAV system will be operating during the DEER Peak Period there will be a demand reduction. The energy savings for this project are approved at an energy savings of 68,291.9 kWh and a DEER Peak demand reduction of 20.19 kW.

Measure Cost

An invoice (Attachment 1) was provided with the IR request. The submitted invoice cost is \$788,000.00 for the equipment cost and work performed. According to Hunter Young, Assistant Civil Engineer with San Rafael Public Works, the PA submitted costs only included the chiller and AHU equipment costs. The IR submitted invoice cost is the sum of material costs plus the cost of labor submitted by the PS. This project cost is approved and does not result in a 50% cost cap incentive adjustment. Table 4 is a summary of the measure cost.

Table 4. Measure Cost

Items	PA Submitted Cost	IR Submitted Cost ¹	Verified Source	IR Approved Cost ¹
Replace Chiller	\$55,500.00	\$291,293.05	Invoice	\$291,293.05
Replace AHU and Terminal Boxes	\$89,330.00	\$496,706.95	Invoice	\$496,706.95
Totals	\$144,830.00	\$788,000.00		\$788,000.00

1) Measure cost by item was not available. Total costs were split based on incentive amount

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Pacific Gas and Electric Company Customized Retrofit - Demand Response

Installation Review Comments

Project #: 2K10039225

Administrator: Eva Chu

Project Name: Chiller Replacement Project

Reviewer: Curtis Lee

Comments

Post-Installation Inspection Summary

Cindy Wu of kW Engineering met Larry Sisseck, Jim Forsythe, and Jeff Stutsman at the City Hall Building in San Rafael, California on July 30, 2013 to conduct the post-installation inspection. The purpose of the post-installation inspection was to record nameplate information and to verify the post-retrofit type, quantities and controls of the equipment retrofitted. Photographs documenting the post-retrofit equipment were taken during the inspection and are attached to this report. The following bullet points summarize the post-installation inspection findings:

- The return fan nameplates of both air handler units (AHU-1, AHU-2) were documented. The supply fan nameplates of both air handlers (AHU-1, AHU-2) were not accessible.
- The fan motor nameplates and VFD settings of supply and return fans of both air handlers (AHU-1, AHU-2) were documented.
- The new VAV boxes were installed in the ceiling plenum and their nameplates were not accessible.
- The chiller nameplate was documented.
- EMS screenshots detailing the HVAC system set points, parameters and operating conditions were documented.
- The building operating hours remain the same as pre-retrofit.

Attachments

Attachment 1 – Project Invoice

Attachment 2 – Approved IR Calculations

Attachment 3 – Phone and Email Logs

**Pacific Gas and Electric Company Customized Retrofit - Demand Response
Installation Review Continued**

Project #: 2K10039225
Project Name: Chiller Replacement Project

Administrator: Eva Chu
Reviewer: Curtis Lee

Summary of Approved Measures

Customized Retrofit

Lighting \$0.05 AC&RII \$0.09 Natural Gas \$1.00
AC&RI \$0.15 Mtrs/Other \$0.09 kW \$100

Old Code	New Code	Measure Description	Meas. Type	Energy Savings			Measure Cost	Gross Incentive		Project Cost Adjustment	PA Contract Adjustment	Net Incentive	
				kW	kWh or Therm			kW	kWh or therm			kW	kWh or therm
S311	CHC11	HVAC Retrofit/New-Chillers-Air Cooled-Efficient Unit	AC&R I	-	31,034.6 kWh	\$299,139.90	\$ -	\$ 4,655.19	\$ -	\$ 655.23	\$ -	\$ 3,999.96	
S315	CHA31	HVAC Retrofit/New-AHU/Package Units-VAV-Convert, incl Terminal Boxes	AC&R I	20.19	37,257.3 kWh	\$488,860.10	\$ 2,019.00	\$ 5,588.60	\$ -	\$ 786.95	\$ 1,232.05	\$ 5,588.60	
				-	-	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
				-	-	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
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				-	-	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
				-	-	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
Approved Totals				20.19	68,291.9 kWh	\$788,000.00	\$ 2,019.00	\$10,243.79	\$ -	\$ 1,442.18	\$ 1,232.05	\$ 9,588.56	
					- Th					TOTAL		\$10,820.61	

Demand Response

Category 1 \$125 Category 2 \$50

Meas. Code	Measure Description	Dispatch Demand(kW)	Measure Cost	Gross Incentive	Project Cost Adjustment	Customer Cap Adjustment	Net Incentive	DR Initial 25% Payment
		-	\$ -	\$ -	\$ -	\$0.00	\$ -	\$ -
		-	\$ -	\$ -	\$ -	\$0.00	\$ -	\$ -
		-	\$ -	\$ -	\$ -	\$0.00	\$ -	\$ -
		-	\$ -	\$ -	\$ -	\$0.00	\$ -	\$ -
		-	\$ -	\$ -	\$ -	\$0.00	\$ -	\$ -
Approved Totals		-	\$ -	\$ -	\$ -	\$0.00	\$ -	\$ -

Pacific Gas and Electric Company Customized Retrofit - Demand Response
Post-Installation Inspection Report

Review Firm: kW Engineering
Application Number: 2K10039225

Project Name: Chiller Replacement Project

Inspector: Cindy Wu

Inspection Date: 7/30/2013

PROJECT/SUBMITTAL INFORMATION

Project Sponsor: City of San Rafael
Host Customer: City of San Rafael
Site Address: 1400 Fifth Street, San Rafael, CA 94901
Customer Contact: Richard Landis
Phone: 415-485-3355

INSPECTION STATUS

Approved

Revisions Required

Declined

INSPECTION FINDINGS

Project Description

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(continued on pg 2)

Pacific Gas and Electric Company Customized Retrofit - Demand Response
Post-Installation Inspection Report - Continued

Application Number: 2K10039225

Inspector: Cindy Wu

Project Name: Chiller Replacement Project

Inspection Date: 7/30/2013

INSPECTION FINDINGS Continued

Post-Installation Inspection Findings

Installed Equipment

AHU-1 Supply Fan (Fan Wall Configuration)

Manufacturer: Baldor Reliance

Spec: 06H835W356G1

Motor HP: 3 Air Over (4 identical motors observed, for a total of 12 HP)

RPM: 1760

NEMA Nom. Eff: 89.5%

AHU-2 Supply Fan (Fan Wall Configuration)

Manufacturer: Baldor Reliance

Spec: 06H835W567G1

Motor HP: 5 Air Over (2 identical motors observed, for a total of 10 HP)

RPM: 1750

NEMA Nom. Eff: 90.2%

AHU-1 Return Fan & Motor

Tag: RF-1 City Hall HVAC 1235C

Fan:

Manufacturer: Loren Cook Company

Model: 330 QMX 330QMX

Design CFM: 11,250

Design SP: 1.0 in. wg

Design RPM: 593

Motor:

Manufacturer: N/A

Motor HP: 5

Motor RPM: 1,725

Encl: ODP

AHU-2 Return Fan & Motor

Tag: RF-2 City Hall HVAC 1235C

Fan:

Manufacturer: Loren Cook Company

Model: 330 QMX 330QMX

Design CFM: 10,125

Design SP: 1.0 in. wg

Design RPM: 676

Motor:

Manufacturer: N/A

Motor HP: 3

Motor RPM: 1,725

Encl: ODP

Chiller

Manufacturer: Carrier

Model: 30RBB08066806 – 3L

Serial: 4310Q75028

Equipment Operation

The AHUs that serve this building are dual duct systems. The first and second floors are served by AHU-1 and the third floor is served by AHU-2. The first floor houses the police department and is occupied 24 hours per day, every day. The second and third floors are occupied Monday through Friday during the hours from 6 AM to 5 PM. When the second floor is unoccupied, the AHU-1 supply fan operates at reduced speed and isolation dampers in the supply duct closes to prevent flow of supply air to the second floor. AHU-2 does not operate when the third floor is unoccupied.

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Pacific Gas and Electric Company Customized Retrofit - Demand Response

Post-Installation Inspection Report - Continued

Application Number: 2K10039225

Inspector: Cindy Wu

Project Name: Chiller Replacement Project

Inspection Date: 7/30/2013

INSPECTION FINDINGS Continued

Post-Installation Inspection Findings (cont)

AHUs

The supply fans are controlled by VFDs that modulate to maintain a duct static pressure set point of 1 in. w.g. The cold deck and hot deck temperature set points reset based on zone demand, in addition, the temperature can also reset based on outside air temperature (OAT) based on the following schedule:

Table 1: Hot Deck and Cold Deck Temperature Reset Schedule

OSAT	Hot Deck Setpoint	Cold Deck Setpoint
> 75	55	72
50 - 75	60	90
< 50	65	120

Both AHUs have economizer dampers that remains at minimum position when OAT > 75°F and OAT < 50°F. When OAT is between 50°F and 75°F, the dampers will modulate to maintain a mixed air temperature, using the same reset schedule as the cooling coils defined in Table 1.

CHW System

The chilled water supply temperature set point is 44°F. When the outside air temperature (OAT) is below 55°F, the chiller and chilled water pumps do not operate.

HHW System

The space heating water supply temperature is maintained at 160°F. When the OAT is above 70°F, the boiler and hot water pump do not operate.