Main project: Hotel - Dryer Modulating Gas Valve

Market Channel: **PG&E Sales**
Program Classification: **Customized Retrofit**
Partner:
Workflow Type: **Custom**
Site Name: [redacted] **JOINT VENTURE -** [redacted] **BLVD -** [redacted]
Created from Lead:
Audit**:**

Program: **Commercial Calculated Incentives - Customized Retrofit**
Project ID: **COCRIPGE13-**[redacted]
Primary Project Contact: [redacted]
Project Sponsor:
Project Sponsor Contact: [redacted]
Customer Payee:
Primary Contractor:

Project Description

Dryer modulating gas valve retrofit

Project Summary

Total kW Savings: 0

Total kWh Savings: 0

Total Therms Savings: 3,358

Total Incentive Amount: $2,050.00

Customer Incentive: $2,050.00

Project Cap Adjustment: -$1,308.00

Total Project Costs: $4,100.00

Total Uncapped Incentive Amount: $3,358.00

Contractor Incentive: $0.00

Additional Incentive:$0.00

Project Measure

PROCESS RETROFIT/NEW-OTHER GAS-MODIFY PROCESS

Pre-Field Report

Pre-Field Report Conducted: *Yes*

Initial Site Visit : 5/8/2015 12:00:00 AM

Site Inspection Overview: On 5/8/2015, [redacted]

A short term test was conducted where the exact same load of laundry was washed and dried twice, once in baseline dryer mode and once in modulating dryer mode. Although the load was washed in the exact same washer there is still some variance in the moisture content of the clothes between each drying. This was accounted for by measuring the BTUs of gas used per lb of moisture removed during the drying process. The clothes were weighed before and after drying for each mode.

The customer and project sponsor understand the rules of the Customized Retrofit program and removed the Bio-Therm once the testing was completed to await Utility Administrator approval to proceed with installation.

Statement of Influence: [redacted]

Baseline Assumptions: The measure application type is a Retrofit Add-On because the nature of the measure includes a control or other mechanism that is added to an existing operating piece of equipment that allows it to operate at higher system efficiencies. Therefore, the baseline for this project is an existing standard commercial dryer with a single burner firing rate.

Existing Equipment: Both gas dryers are Cissell Commercial Tumblers. The larger dryer's model # is L125UROG. It has a capacity of 125 lb and a heating input of 370 MBH. The smaller one has a heating input of 300 MBH. Its model # was not recognizable from the nameplate photo.

Proposed Equipment: (2x) Bio-Therm Upgrade

- This emerging retrofit technology comes in a kit form that allows a single stage gas valve to be replaced in an existing dryer with a two stage gas valve and associated controls to provide the low fire and high fire burner operation.

Based on the manufacturer, the EUL for the proposed equipment is around 15 years.

Existing Operation: Provided in the "Pre-Field Report (Engineer)" section above.

Proposed Operation: The retrofit will add modulating capabilities to the gas dryer which allows the firing rate to adjust to the changing demand for heat over the drying cycle. Thus, less natural gas is consumed to run the same laundry and dryer operation.

Based on the short term field test, it was found that the proposed equipment add-on reduced BTUs per lb of moisture by 25.5%.

Calculation Methodology: The estimate potential gas savings, the following methods were carried out:

- A short term test was conducted where the exact same load of laundry was washed and dried twice, once in baseline dryer mode and once in modulating dryer mode. This determines the difference in BTUs per lb of moisture removed for a single cycle.

- Motor ON/OFF loggers were deployed on both dryers' drum motors for 3-weeks from 5/15/2015 to 6/5/2015 to estimate average dry cycles per year.
- Excel spreadsheets were used to analyze test data and calculate energy savings.

Short term field test

In baseline mode the gas usage was calculated by monitoring the dryer gas valve on time with a current switch and multiplying by the nameplate (high) firing rate of the dryer. For the modulating dryer valve both the high fire and low fire on times were monitored with separate current switches. The low firing rate was determined by measuring the manifold pressure setting of the gas valve with a digital manometer and using the following flow calculation:

New (Low) Firing Rate (Btu/hr) QN = QO * √ (
PN/PO) Where QN = Low Firing Rate (Btu/hr)
QO = High Firing Rate
(Btu/hr) √ = Square Root
PN = Low Firing Rate Manifold Pressure (inch water column – "WC) PO
= High Firing Rate Manifold Pressure (inch water column – "WC)

	Dryer #1	Dryer #2
High Fire Rate BTU/Hr:	370,000	300,000
Low Fire Rate Manifold Pressure (WC):	1.1	1.1
High Fire Rate Manifold Pressure (WC):	2.5	2.5
Low Firing Rate BTU/hr:	245,430	198,997

During the test, dryer run time was kept constant at 30 minutes dry and 5 minutes cooldown. Although the load was washed in the exact same washer there is still some variance in the moisture content of the clothes between each drying. This was accounted for by measuring the Btus of gas used per lb of moisture removed during the drying process. The clothes were weighed before and after drying for each mode. It was found that the proposed equipment add-on reduced BTUs per lb of moisture by 25.5% for a cycle of laundry.

Motor logging

(2x) HOBO Motor loggers deployed from 5/15/2015 to 6/5/2015

	Dryer #1	Dryer #2
Average cycle time:	0:32:48	0:41:52
Total drying time:	181:27:34	223:15:22
Average cycles during this period:	332	320
Average cycles per year:	5,755	5,547

Spreadsheet calculations

System Specifications	Dryer #1	Dryer #2	Notes
High Fire Rate/BTU Input (BTU/hr)	370,000	300,000	Nameplate
High Fire Gas Manifold Pressure (in w.c.)	2.5	2.5	Spot measurement
Low Fire Gas Manifold Pressure (in w.c.)	1.1	1.1	Spot measurement
Avg time per dry cycle (Hrs)	0.55	0.70	Based on 3-weeks data logging (5/15/2015 - 6/5/201
Low Fire Rate (BTU/hr)	245,430	198,997	Calculated from gas manifold pressure reduction, se
Dryer cycles per yr	5,755	5,547	Based on 3-weeks data logging (5/15/2015 - 6/5/201
Baseline			
High Fire Burner ON %	65%	65%	Short term test result, back-calculated to compare s
Low Fire Burner ON %	0%	0%	No modulation
Natural Gas Usage (Therms/yr)	7,537.46	7,519.15	Therms/yr = (BTU/hr)*(Burner hrs ON/cycle)*(Cycles
Proposed			
High Fire Burner ON %	17%	17%	Short term test result
Low Fire Burner ON %	47%	47%	Short term test result
Natural Gas Usage (Therms/yr)	5,612.05	5,598.41	Therms/yr = (BTU/hr)*(Burner hrs ON/cycle)*(Cycles
Savings			
Natural Gas Savings (Therms/yr)	1,925.42	1,920.74	Baseline Gas Usage - Proposed Gas Usage

See attached 2K1500024222 Preliminary Energy Calculation.xlsx

Pre-Installation Inspection and Project Review

Pre-Inspection Required : True

Pre-Inspection Date : 5/8/2015 12:00:00 AM

Use Engineer's Pre-Field Report?: Yes

Reason Engineer's Pre-Field Not Used:

Pre-Installation Inspection: True

M&V Plan: N/A

Energy Savings: Revised

[redacted]

A short term test was conducted where the exact same load of laundry was washed and dried twice, once in baseline dryer mode and once in modulating dryer mode. Although the load was washed in the exact same washer there is still some variance in the moisture content of the clothes between each drying. This was accounted for by measuring the BTUs of gas used per lb of moisture removed during the drying process. The clothes were weighed before and after drying for each mode.

The customer and project sponsor understand the rules of the Customized Retrofit program and removed the Bio-Therm once the testing was completed to await Utility Administrator approval to proceed with installation.

Statement of Influence (TR): [redacted]

Baseline Assumptions (TR): The measure application type is a Retrofit Add-On because the nature of the measure includes a control or other mechanism that is added to an existing operating piece of equipment that allows it to operate at higher system efficiencies. Therefore, the baseline for this project is an existing standard commercial dryer with a single burner firing rate.

Existing Equipment (TR): Both gas dryers are Cissell Commercial Tumblers. The larger dryer's model # is L125UROG. It has a capacity of 125 lb and a heating input of 370 MBH. The smaller one has a heating input of 300 MBH. Its model # was not recognizable from the nameplate photo.

Proposed Equipment (TR): The proposed equipment is a Bio-Therm modulating gas valve kit with a two-stage gas valve and associated controls. The single-stage gas valve in the existing dryer will be replaced by the new gas valve so the dryers can be retrofitted to two-stage firing.

Existing Operation (TR): Provided in the "Pre-Field Report (Engineer)" section above.

Proposed Operation (TR): Similar to the existing burner control, the modulating gas valve still uses the dryer drum exhaust air temperature as the control target, and maintains it at 130°F. At the beginning of the drying process when the moisture load is high, high and low firing stage alternate to maintain the target temperature set-point. Near the end of the drying process when the moisture load is low, the gas valve alternates between low-firing stage and off to maintain the set-point.

Calculation Methodology (TR): **Calculation Methodology**
PG&E and the Project Sponsor conducted short-term tests and data logging, and estimated the energy savings from the short-term data. Nexant made some revisions to the analysis. The analytical procedures and the revisions to the submitted calculations are described below:

1. Two short-term tests were conducted on one of the dryers to determine the drying efficiency (in terms of heating energy use per pound moisture removed) of the baseline single-stage dryer and the proposed two-stage dryer. The same load of laundry was washed and dried twice, once in baseline dryer mode and once in modulating dryer mode, with the dryer run time kept constant at 30 minutes dry and 5 minutes cool down, typical of a normal drying process in this facility.The drying efficiency was determined using the following equation:

Drying efficiency = [(High firing rate * High firing stage on-time) + (Low firing rate * Low firing stage on-time)] / Moisture removed

Where:
1) The low firing rate and the low firing rate on-time are zero for the baseline single-stage dryer;
2) The low firing rate for the proposed valve was determined using measured manifold pressure of the high and low firing stage, the high firing rate and the equation provided in the "Calculation Methodology" section of the Pre-Field Report (Engineer);
3) Stage on-time was measured with one current counter on the solenoid of the baseline single-stage gas valve and two current counters for the proposed gas valve, one on the solenoid of the high-stage and the other one on the low-stage solenoid.

With the baseline and the proposed drying efficiency, an efficiency improvement percent was calculated for the dryer with the modulating gas valve against the baseline.

The baseline test also determined the percent burner on-time relative to the entire drying cycle (including the cool-down time), which was used to calculate the baseline annual heating energy use of the dryers in Step 3.

In the Pre-Field Report (Engineer), because the baseline dryer removed less moisture than the proposed dryer, an equivalent high fire time to achieve the same amount of moisture removal as the proposed case was proportionally calculated based on the actual baseline burner on-time and the moisture removal ratio between the baseline and the proposed. This equivalent burner on-time was used in the baseline heating energy use of the dryers. However, Nexant thinks the actual baseline burner on-time was the amount of time the baseline dryer actually took to dry a load of laundry in a typical 35 min drying cycle. It is this time, instead of the prorated equivalent time, that should be used in the calculation of the baseline heating energy consumption. Although the proposed dryer may dry the same load of laundry a little more in the same amount of time, the fact won't impact the baseline energy use. On the contrary, the proposed dryer may run shorter to achieve the same drying effect as the baseline dryer. The drying efficiency defined in the equation above has already ensured a fair energy efficiency comparison.

2. On/off status of both dryers' drum motors was logged for three weeks. From the motor status trend data, average drying cycle time and an equivalent annual number of drying cycles were derived for each dryer.

The Pre-Field Report (Engineer) summed the total number of dryer cycles during the trending period, divided by 3 and multiplied by 52 to get the annual number of dryer cycles because the trending period was approximately 3 weeks. However, because the trending time was not exactly 3 weeks, to be more accurate, Nexant used the exact length of the trending period and the annual 8,760 hours to proportionally calculate the annual number of dryer cycles.

3. Baseline dryer heating energy use was calculated for both dryers using the following equation:

Baseline heating energy use = Dryer cycles per yr * Avg. time per dry cycle * Percent burner on-time per cycle * High firing rate

Where:
Percent burner on-time per cycle = Actual burner on-time / 35 mins (based on the baseline short-term test)

4. The savings were determined to be the baseline energy multiplied by the drying efficiency improvement percent derived in Step 1.

The recommended annual energy savings are [redacted] therms. The recommended annual energy savings is approximately 1.44% of the gas consumption for the customer's most recent 12 months of usage, based on PG&E billing data.

Because the proposed measure performance has already been tested with both baseline and post-installation gas consumption measured on one of the two dryers under guidance from PG&E engineer Gabriel Jew, for IR verification the modulating gas valve must be verified as installed and functioning as proposed with a two-fire rate operating profile.

Measure Cost

The customer provided a full measure cost (FMC) of $4,100.00 for two modulating gas valve kits, which includes material costs and labor costs. The estimated cost was reviewed and is considered reasonable. The Project Sponsor must submit itemized project invoices during the Installation Review (IR) to document the actual project installation costs.

2015 CUSTOMIZED RETROFIT - DEMAND RESPONSE AGREEMENT

This Agreement is entered into by [Pacific Gas and Electric Company] ("UTILITY") and the Project Sponsor (third party entity or UTILITY Customer if self-sponsored), as indicated. Project Sponsor agrees to review these terms and conditions. Any implementation of this project will be deemed the Project Sponsor's acceptance of these terms and conditions. If these terms and conditions are not acceptable, the Project Sponsor must notify UTILITY and refrain from any implementation of the project, otherwise will do so at their own risk.

Application Information

Project Name	Hotel - Dryer Modulating Gas Valve
Project Number	COCRIPGE13-[redacted]
Application Number	2K15000[redacted]
Date Received	6/11/2015

Calculated X *M&V Required*

UTILITY Customer Information

[redacted]

Company Name
Gary Hauck

Corp Parent Name
Email [redacted]
m

NA
NA NA 99999

Telephone
Fax

Tax Status Exempt Reason COMPANY/CORP. FEDERAL TAX ID

Project Sponsor Information

Company Name
Mark Seipke

Corp Parent Name if applicable
Email

NA
NA NA 99999

Telephone [redacted]
Fax

Tax Status Exempt Reason COMPANY/CORP. FEDERAL TAX ID

Site Information

Site Name
[redacted]

Site ID number if applicable
Telephone [redacted]

Electric Service Agreement ID

Gas Service Agreement ID

Approved Customized Retrofit Estimate

MEASURE DESCRIPTION	kWh	Permanent kW	Therms	$ Amount
PROCESS RETROFIT/NEW-OTHER GAS-MODIFY	.00	.00	3,358	$3,358.00
Sub-Total	.00	.00	3,358	$3,358.00
		Project Cost Adjustment		$4,100.00
		Site Cap Adjustment		($1,308.00)
		Total Incentive		**$2,050.00**

1.0 **PROJECT DESCRIPTION** This Agreement is limited to the **CUSTOMIZED RETROFIT - DEMAND RESPONSE** (“CR-DR”) Project(s) (“Project(s)”) described on the Customized Energy Efficiency/Demand Response Incentive Application and CR-DR Form (both together referred as “Application”) incorporated by reference into this Agreement. As stated in the Application, UTILITY shall pay incentives in accordance with the terms and conditions of this Agreement.

1.1 **Documents Incorporated by Reference** The following documents are incorporated by reference and are made part of this Agreement: Project Sponsor’s approved Application, UTILITY acceptance letter(s) based on measures proposed in the Application, and the 2013-15 CR-DR Procedures Manual (“Program Manual”).

2.0 **ELIGIBILITY** CR-DR funding is limited and is available on a first come, first served basis. Funds will be reserved only upon UTILITY approval of the Application. The CR-DR Program offers two types of incentives, Non Residential Retrofit and Demand Response. A Project may be eligible for one or both of these incentives.

3.0 **SUBMITTAL REQUIREMENTS FOR PAYMENT**

4.0 **INSPECTIONS**

5.0 **REVIEW AND DISCLAIMER**

6.0 **PAYMENTS**

6.1 **CR INCENTIVE PAYMENTS**

6.2 **DR INCENTIVE PAYMENTS**

7.0 **PAYMENT DISQUALIFICATION**

8.0 **TERM AND TERMINATION**

9.0 **ASSIGNMENT**

10.0 **PERMITS AND LICENSES**

11.0 **ADVERTISING, MARKETING AND USE OF UTILITY’S NAME**

12.0 **INDEMNIFICATION**