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FOOD SERVICE

COMMERCIAL FRYER – GAS TO ELECTRIC FUEL SUBSTITUTION

SWFS021-01

CONTENTS

MEASURE NAME

Commercial Fryer - Gas to Electric Fuel Substitution

STATEWIDE MEASURE ID

SWFS021-01

TECHNOLOGY SUMMARY

Commercial fryers are among the most common appliances in commercial food service facilities. All fryers share a common basic design. The fry vat contains enough oil so that the cooking food is essentially supported by displacement of the oil rather than by the bottom of the vessel. Two fryer attributes width and energy-input rating – suggest the approximate amount of food a fryer can prepare within a given period, which is one of the most important factors in choosing the proper fryer for a kitchen.

Large vat fryers have fry pots ranging from 18 x 14 inches to 34 x 34 inches; the most common is the 18 x 18-inch size. Large vat fryers are becoming more common in restaurants as they replace smaller (14 inch) fryers to increase production capability while maximizing the available space in the kitchen.

This technology category has historically been driven by the lowest first cost and traditionally has not incorporated energy-efficient features. Recent advances in fryer design, however, have increased fryer operational efficiency as well as safety. Energy-efficient commercial fryers reduce energy consumption primarily through advanced burner and heat exchanger design, advanced controls, and insulation. ENERGY STAR®-rated fryer models enable the differentiation between high-efficiency and standard-efficiency models. ENERGY STAR-qualified fryers offer shorter cook times and higher production rates, and frypot insulation reduces standby losses resulting in a lower idle energy rate.

This measure specification follows the American Society for Testing and Materials (ASTM) Standard Test Method for the Performance of Open Deep Fat Fryers (F1361)[1] and the ASTM Standard Test Method for the Performance of Large Vat Fryers (F2144)[2] for calculation of energy use and demand, based on testing in an approved and qualified laboratory.

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[1] American Society for Testing and Materials (ASTM). 2013. *ASTM F1361, Standard Test Method for the Performance of Open Deep Fat Fryers.* West Conshohocken (PA): ASTM International.

[2] American Society for Testing and Materials (ASTM). 2016. *ASTM 2144-09, Standard Test Method for the Performance of Large Vat Fryers.* West Conshohocken (PA): ASTM International.

MEASURE CASE DESCRIPTION

The measure case specification represents the performance characteristics of equipment that meets or exceed the ENERGY STAR certification requirements (See Program Requirements). The measure case specification accounts for idle energy rate, cooking efficient rate, and production capacity of a commercial fryer. The measure case specification values represent the average values of the analysis with the tested equipment data, ENERGY STAR certified product list, and the qualifying product list for California foodservice equipment rebate programs (2019). The data from these sources of commercial gas fryers were compiled and analyzed in 2019; the results of which were summarized by The Southern California Gas Company (SCG) in a memo and supplemental attachment.[3, 4]

Measure Case Specification

Fryer Type	Idle Energy Rate	Cooking Energy Efficiency	Production Capacity (lb/hr)	Preheat Energy	Source
Electric	0.682 kW	86%	62	1.56 kWh	The Southern California Gas Company (SCG). 2019. “Update Plan_Fryer_12142019.xlsx”

BASE CASE DESCRIPTION

The base case specification represents the performance characteristics of equipment that does not meet ENERGY STAR certification requirements. Since commercial fryers are not covered by state or national codes, there is little incentive for equipment manufacturers to test their baseline equipment. Therefore, the baseline efficiency was determined from equipment tested by the Food Service Technology Center (FSTC) and Food Service Testing Lab (FSTL, SCG), updated in 2019 [4].

Base Case Specification

Fryer Type	Idle Energy Rate	Cooking Energy Efficiency	Production Capacity (lb/hr)	Preheat Energy	Source
Gas	12,847 Btu/hr	37%	58	16,415 Btu	The Southern California Gas Company (SCG). 2019. “Update Plan_Fryer_12142019.xlsx”

CODE REQUIREMENTS

This measure is not governed by either state or federal codes and standards.

Applicable State and Federal Codes and Standards

Code	Applicable Code Reference	Effective Date

[3] The Southern California Gas Company (SCG). 2019. “SWFS011_Commercial Fryer Proposed Changes_10252019.zip” Memorandum submitted to Peter Biermayer (Energy Division) and Sue Haselhorst (Ex Ante Review Team).

[4] The Southern California Gas Company (SCG). 2019. “Update Plan_Fryer_12142019.xlsx.”

CA Appliance Efficiency Regulations – Title 20	None.	n/a
CA Building Energy Efficiency Standards – Title 24	None.	n/a
Federal Standards	None.	n/a

This measure specification follows the American Society for Testing and Materials (ASTM) Standard Test Method for the Performance of Open Deep Fat Fryers (F1361)[5] and the ASTM Standard Test Method for the Performance of Large Vat Fryers (F2144)[6] for calculation of energy use and demand, based on testing in an approved and qualified laboratory.

NORMALIZING UNIT

Each (fryer).

PROGRAM REQUIREMENTS

Fuel Substitution Test

Per CPUC Decision 19-08-009 Rulemaking 13-11-005 "Decision Modifying the Energy Efficiency Three-Prong Test Related to Fuel Substitution", for all fuel substitution measures, the measure must 'not increase total source energy consumption when compared with the baseline comparison measure available utilizing the original fuel'. [7] Also, the measure 'must not adversely impact the environment compared to the baseline measure utilizing the original fuel. Fuel substitution calculations were conducted using CPUC's "Fuel Substitution Calculator" to confirm the measures in this workpaper pass Part One and Two of the Fuel Substitution Test[8].

Measure Implementation Eligibility

All combinations of measure application type, delivery type, and sector that are established for this measure are specified below. Measure application type is a categorization based on the circumstances and timing of the measure installation; each measure application type is distinguished by its baseline determination, cost basis, eligibility, and documentation requirements. Delivery type is the broad categorization of the delivery channel through which the market intervention strategy (financial incentives or other services) is targeted. This table also designates the broad market sector(s) that are applicable for this measure.

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[5] American Society for Testing and Materials (ASTM). 2013. *ASTM F1361, Standard Test Method for the Performance of Open Deep Fat Fryers.* West Conshohocken (PA): ASTM International.

[6] American Society for Testing and Materials (ASTM). 2016. *ASTM 2144, Standard Test Method for the Performance of Large Vat Fryers.* West Conshohocken (PA): ASTM International.

[7] California Public Utilities Commission (CPUC). 2019. "Decision 19-08-009 Rulemaking 13-11-005 Decision Modifying the Energy Efficiency Three-Prong Test Related to Fuel Substitution". August 1.

[8] Southern California Edison (SCE). 2019. "SWWH025-01 Fuel Substitution Calculator.xlsx".

Note that some of the implementation combinations below may not be allowed for some measure offerings by all program administrators.

Implementation Eligibility for Investor-Owned Utilities

Measure Application Type	Delivery Type	Sector
Normal replacement	UpDeemed	Ag
Normal replacement	UpDeemed	Ind
Normal replacement	UpDeemed	Com
Normal replacement	DnDeemed	Ag
Normal replacement	DnDeemed	Ind
Normal replacement	DnDeemed	Com
Normal replacement	DnDeemDI	Ag
Normal replacement	DnDeemDI	Ind
Normal replacement	DnDeemDI	Com

Required Documentation for Normal Replacement in Upstream and Mid-Stream Delivery

For upstream/mid-stream delivery method, the participant baselines are unknown and the spillover effects are unknown. The manufacturer or distributor doesn't know whether the purchased measure is replacing a gas or an electric baseline appliance. Claimed savings for these delivery types will be adjusted using the ratio of baseline gas appliance to total baseline appliances. These ratios will be determined from Commercial Food Service Technologies Participant Study[9]. The implementer shall survey 10% of the mid-stream installations, to determine actual gas/electric baseline proportions, and the program administrator shall adjust claimed savings based upon these survey results." This survey will be conducted annually and sample survey questions are as follows:

"What was the fuel source of the equipment you replaced?"

a. Gas
b. Electric
c. I don't know/I'm not sure

In addition, for mid-stream delivery method, the implementer should provide the retailer or distribution location where the product was sold, rated capacity, and proposed building type where the product will be installed.

A survey will not be issued for upstream delivery method.

Required Documentation for Normal Replacement, New Construction, and Accelerated Replacement in Downstream and Direct Install Delivery

[9] SoCalGas, 2019. "Commercial Food Service Technologies Participant Study" prepared by BASE Energy

For downstream deemed and downstream direct-install delivery types, in addition to the standard information such as building type, climate zone, and capacity of the units, the following data must be submitted with each project application by the project developer:

- What is the existing fuel type for the existing equipment?
- Did the site require any electric infrastructure upgrades for the proposed electrification measure? If yes, provide the itemized invoices with infrastructure upgrade costs.
- Did the owner install any other electrification measures at this site? If yes, list the measures and provide the itemized invoices with infrastructure upgrade costs (if any).

Eligible Products

This measure includes new electric commercial fryers that are ENERGY STAR-qualified[10] or meet the qualifications in the Measure Case Description.

Eligibility Requirements

Fuel Type	Fryer Type	Heavy-Load Cooking Efficiency	Idle Energy Rate	Source
Electric	Standard	≥ 83%	≤ 800 Watts	ENERGY STAR. 2015. "ENERGY STAR® Program Requirements for Commercial Fryers: Version 3.0." Effective October 1, 2016.
	Large Vat	≥ 80%	≤ 1,100 Watts	

Eligible Building Types and Vintages

This measure is applicable for any nonresidential building type and any vintage.

Eligible Climate Zones

This measure is applicable in all California climate zones.

Incentive Requirements

Deployment of the program may require rebates or financial incentives to participants that exceed the Incremental Measure Cost (IMC).[11] Incentives or rebates that exceed the incremental cost for a measure must be justified by individual PAs in addendum to workpaper submissions to document program implementation practice prior to program implementation.

[10] ENERGY STAR. 2015. "ENERGY STAR® Program Requirements for Commercial Fryers: Version 3.0." Effective October 1, 2016

[11] Originally defined in D.92-09-080, the dual test was last modified in D.05-04-051

PROGRAM EXCLUSIONS

This measure is not applicable for new construction installations.

DATA COLLECTION REQUIREMENTS

Per CPUC Decision 19-08-009[12], building infrastructure costs which include panel upgrades or gas line installations/upgrades required to facilitate these fuel substitution measures shall be collected for all downstream and direct install measures. This revision incorporates the analysis of data collected from equipment tests, IOU rebates, CEC/ENERGY STAR database, surveys, and interviews with experts in the industry. Additional updates to this workpaper could be made when more installation and equipment data become available.

USE CATEGORY

Food service (FoodServ)

ELECTRIC SAVINGS (KWH)

There are no electric savings because the fuel substitution measure includes replacing an existing gas fryer with an electric fryer. Therefore, electric usage at the facility will increase.

Annual Electric Unit Energy Consumption

The daily electric UEC (baseline or measure case) is equal to the sum of the energy required for cooking, preheat, and idle modes of fryer operation. These calculations and the inputs are provided below.

$$UEC\_DAY = cooking\ energy + idle\ energy + preheat\ energy$$

Cooking energy is a function of the pounds of food cooked per day, the energy absorbed per pound of food product during cooking, and the measured heavy load cooking energy efficiency.

$$cooking\ energy = \left[\frac{LBFOOD \times EFOOD}{EFFICIENCY \times Btu/kWh}\right]$$

LBFOOD =	*Estimated pounds of food cooked per day (lb)*
EFOOD =	*ASTM energy to food ratio, the energy absorbed by food during cooking (Btu/lb)*
EFFICIENCY =	*Measured heavy load cooking efficiency (%, decimal format)*
Btu/kWh =	*Btu to kWh conversion factor*

Preheat energy is calculated as the product of the assumed number of preheats per day and the energy required per preheat mode.

$$preheat\ energy = (nP\ x\ EP)$$

[12] California Public Utilities Commission (CPUC). 2019. "Decision 19-08-009 Rulemaking 13-11-005 Decision Modifying the Energy Efficiency Three-Prong Test Related to Fuel Substitution". August 1

$nP =$	*Estimated number of preheats per day (#)*
$EP =$	*Measured preheat energy (kWh)*

Idle energy is a function of the idle energy rate, operating hours per day, and production capacity; idle energy does not include preheat time.

$$idle\ energy = \left[IDLERATE \times \left(EHOUR - \frac{LBFOOD}{PC} - (nP\ \times TP/MinHr)\right)\right]$$

$IDLE\ RATE =$	*Measured idle energy rate (kW)*
$EHOUR=$	*Estimated operating hours per day (hrs)*
$LBFOOD =$	*Estimated pounds of food cooked per day (lbs)*
$PC =$	*Measured production capacity (lbs/hr)*
$nP =$	*Estimated number of preheats per day (#)*
$TP =$	*Estimated preheat time (min)*
$MinHr =$	*Constant, 60 minutes per hour (min)*

The **annual UEC** is calculated as the daily UEC multiplied by the number of operating days per year.

$$UEC\_YEAR = UEC\_DAY \times EDAYS$$

$UEC\_DAY =$	*Daily unit energy consumption (kWh)*
$EDAYS=$	*Estimated operating days per year (days)*

Annual Electric Unit Energy Savings

The **annual UES** is calculated as the difference between the baseline and measure case annual UEC.

$$UES_{YEAR} = [UEC\_YEAR_{Base} - UEC\_YEAR_{Measure}]$$

$UEC\_YEAR =$	*Annual UEC, baseline or measure (kWh/year)*
$UES\_YEAR=$	*Annual UES (kWh/year)*

Note that for measures implemented through investor-owned utility (IOU) portfolios, Decision 11-07-030 stipulated an adjustment to the UES: "Energy Division believes that operating hours, food production rates and baseline efficiencies contribute to overly optimistic UES calculations and recommend a 30% reduction in UES values." [13] These operating characteristics were investigated and revised in 2019 and incorporated into the UEC calculation,[3] thus the 30% reduction factor is excluded from the UES calculation.

Inputs and Assumptions

The inputs for the calculation of the UES of an electric fryer are specified below. The CPUC issued disposition, "Non-standard Disposition for the commercial electric and gas Fryer workpaper SWFS011-01," [14] required the collection and analysis of secondary source test data. Electric fryers represent a smaller share of the market segment than gas fryers and, thus baseline data in both a lab and field

[14] Biermayer, P. (CPUC, Energy Division). 2019. "Non-standard Disposition for commercial electric and gas fryer workpaper SWFS011-01." Memorandum to Chan Paek (SoCalGas). January 4.

context is scarce. Measure case assumptions were further updated in 2019 based on the findings of the 2019 analysis per CPUC review comments from November 2019 [15]

The assumed hours and days of operation are calculated from on-site monitored data and responses from surveys as shown in the referenced source.

Electric UEC Inputs

Parameter	Measure Case Model	Source
Number of Preheats per Day (#/day)	1	The Southern California Gas Company (SCG). 2019. "Update Plan_Fryer_12142019.xlsx"
Preheat Time (minutes)	8.9	
Fryer Size (inches)	12.4	
Preheat Energy (kWh)	1.56	
Idle Energy Rate (kW)	0.682	
Heavy Load Cooking Energy Efficiency (%)	86%	
Production Capacity (lbs/hr)	62.1	
Pounds of Food Cooked per Day	111	
ASTM Energy to Food (kWh/lb)	0.167	
Operating Hours/Day	12	
Operating Days/Year	351	

A sample calculation of daily electric UEC is provided below.

$$UEC\_DAY = cooking\ energy + idle\ energy + preheat\ energy$$

$$Cooking\ energy = \left[\frac{111 \times 570 \times \frac{1}{3412.14}}{0.86}\right] = 21.55\ kWh/day$$

$$idle\ energy = \left[0.682 \times \left(12 - \frac{111}{62.1} - (1\ \times\ 8.9/60)\right)\right] = 6.86\ kWh/day$$

$$preheat\ energy = \ (1 \times 1.56) = 1.56\ kWh/day$$

$$UEC\_DAY = 21.56 + 6.44 + 1.56 = 29.98\ kWh/day$$

PEAK ELECTRIC DEMAND REDUCTION (KW)

In accordance with the requirements of the CPUC Fuel Substitution Technical Guidance, for Energy Efficiency, October 31, 2019, there will not be any peak demand reduction or penalty towards peak demand goal achievement from fuel substitution measures.[16]

[15] The Southern California Gas Company (SCG). 2019, "Foodservice comment responses_SCG_11222019.xlsx", Response to CPUC's review comments.

[16] California Public Utilities Commission. 2019. "Fuel Substitution Technical Guidance for Energy Efficiency".

GAS SAVINGS (THERMS)

The annual gas unit energy saving (UES) is calculated as the difference between the baseline and measure annual unit energy consumption (UEC). This is a fuel substitution measure therefore the baseline gas usage will be saved and will be replaced with electric consumption.

Annual Gas Unit Energy Consumption

As shown below, the daily gas UEC (baseline or measure case) is equal to the sum of the energy required for cooking, preheat, and idle modes of fryer operation. These calculations and the inputs are provided below.

$$UEC\_DAY = cooking\ energy + idle\ energy + preheat\ energy$$

Cooking energy is a function of the pounds of food cooked per day, the energy absorbed per pound of food product during cooking, and the measured heavy load cooking energy efficiency.

$$cooking\ energy = \left[\frac{LBFOOD \times EFOOD}{EFFICIENCY}\right]$$

$LBFOOD =$	*Estimated pounds of food cooked per day (lbs)*
$EFOOD =$	*ASTM energy to food ratio, the energy absorbed by food product during cooking (Btu)*
$EFFICIENCY =$	*Measured heavy load cooking efficiency (%, decimal format)*

Preheat energy is calculated as the product of the assumed number of preheats per day and the energy required per preheat mode.

$$preheat\ energy = (nP\ x\ EP)$$

$nP =$	*Estimated number of preheats per day (#)*
$EP =$	*Measured preheat energy (Btu)*

Idle energy is a function of the idle energy rate, operating hours per day, and production capacity; idle energy does not include preheat time.

$$idle\ energy = \left[IDLERATE \times \left(EHOUR - \frac{LBFOOD}{PC} - (nP\ \times\ TP/60)\right)\right]$$

$IDLE\ RATE =$	*Measured idle energy rate (Btu)*
$EHOUR =$	*Estimated operating hours per day (hrs)*
$LBFOOD =$	*Estimated pounds of food cooked per day (lbs)*
$PC =$	*Measured production capacity (lbs/hr)*
$nP =$	*Estimated number of preheats per day (#/day)*
$TP =$	*Estimated preheat time (min)*

The **annual UEC** (baseline or measure) is calculated as the daily UEC multiplied by the number of operating days per year.

$$UEC\_YEAR = \frac{UEC\_DAY \times EDAYS}{BtuTherm}$$

$UEC\_DAY =$	*Calculated daily energy consumption (Btu/day)*
$EDAYS =$	*Estimated operating days per year (days)*

BtuTherm = *Btu to therm conversion factor*

Adjusted Annual Gas Unit Energy

The **annual gas UES** is calculated as the difference between the baseline and measure annual UEC.

$$UES_{YEAR} = [UEC\_YEAR_{Base} - UEC\_YEAR_{Measure}]$$

UEC_YEAR = *Annual UEC, baseline or measure (therms/year)*
UES_YEAR= *Annual UES (therms/year)*

Note that for measures implemented through investor-owned utility (IOU) portfolios, Decision 11-07-030[17] stipulated a downward adjustment to the UES: "Energy Division believes that operating hours, food production rates and baseline efficiencies contribute to overly optimistic UES calculations and recommend a 30% reduction in UES values." These operating characteristics were investigated and revised and incorporated into the UEC calculation, [3] thus the 30% reduction factor is now excluded from the UES calculation.

Inputs and Assumptions

The inputs for the calculation of the UES of an electric fryer are specified below. The CPUC issued disposition, "Non-standard Disposition for the commercial electric and gas Fryer workpaper SWFS011-01," [18] required the collection and analysis of secondary source test data. This data was collected from the FSTC and ENERGY STAR certified product database and combined with other data sources into a comprehensive spreadsheet to revise baseline and measure assumptions and to verify efficiency eligibility requirements.

Gas UEC Inputs

Parameter	Base Case Model	Source
Number of Preheats per Day (#/day)	1	The Southern California Gas Company (SCG). 2019. "Update Plan_Fryer_12142019.xlsx"
Preheat Time (minutes)	7	
Fryer Size (inches)	14	
Preheat Energy (Btu)	16,415	
Idle Energy Rate (Btu/hr)	12,847	
Heavy Load Cooking Energy Efficiency (%)	37%	
Production Capacity (lbs/hr)	58	
Pounds of Food Cooked per Day	111	
ASTM Energy to Food (Btu/lb.)	570	
Operating Hours/Day	12	

[18] Biermayer, P. (CPUC, Energy Division). 2019. "Non-standard Disposition for commercial electric and gas fryer workpaper SWFS011-01." Memorandum to Chan Paek (SoCalGas). January 4.

Parameter	Base Case Model	Source
Operating Days/Year	351	

A sample base-case calculation of daily UEC is provided below.

$$EDAY = cooking\ energy + idle\ energy + preheat\ energy$$

$$Cooking\ energy = \left[\frac{111 \times 570}{.37}\right] = 170{,}596.8\ Btu$$

$$idle\ energy = \left[12{,}847 \times \left(12 - \frac{111}{58} - (1\ \times\ 7/60)\right)\right] = 126{,}410.8\ Btu$$

$$preheat\ energy = \ (1\ \times 16{,}415) = 16{,}415.4\ Btu$$

$$EDAY = 170{,}597 + 128{,}079 + 16{,}415 = 313{,}423\ \ Btu$$

LIFE CYCLE

Effective useful life (EUL) is an estimate of the median number of years that a measure installed through a program is still in place and operable. Remaining useful life (RUL) is an estimate of the median number of years that a technology or piece of equipment replaced or altered by an energy efficiency program would have remained in service and operational had the program intervention not caused the replacement or alteration.

The EUL specified for gas and electric commercial fryers are specified below. Note that RUL is only applicable for add-on and accelerated replacement measures and not applicable for this measure.

Effective Useful Life and Remaining Useful Life

Parameter	Value	Source
EUL (yrs)	12	Robert Mowris & Associates. 2005. *Ninth Year Retention Study of the 1995 Southern California Gas Company Commercial New Construction Program*. Prepared for Southern California Gas Company. Study ID Number 718A. California Public Utilities Commission (CPUC), Energy Division. 2003. *Energy Efficiency Policy Manual v 2.0.* Page 18 Table 4.1.
RUL (yrs)	n/a	n/a

BASE CASE MATERIAL COST ($/UNIT)

The base case material cost for equipment *delivered via direct install* is equal to $0.

For *all other delivery types*, the base case material cost was calculated as the average of the manufacturer list prices for electric and gas commercial fryers retrieved from the AutoQuotes online catalog for foodservice equipment and supplies.[19] Because it is common knowledge that dealers do not pay the published list prices for equipment, it was necessary apply a discount factor to the AutoQuotes data to more accurately reflect the actual prices paid for the equipment. The discount factor of 50% was based upon professional judgement by Food Service Technology Center (FSTC) staff. Additional analysis to validate the reasonableness of this value was conducted by comparing AutoQuotes published prices with actual prices on invoices submitted through the Southern California Gas Company Instant Rebates! point-of-sale rebate program from 2015 through August of 2017.[20] This verification revealed that a "list-to-actual" cost ratio for food service equipment of 50% is a reasonable average discount factor.

MEASURE CASE MATERIAL COST ($/UNIT)

The measure case material cost for *all delivery types* was calculated as the average of the manufacturer list prices for electric and gas commercial fryers retrieved from the AutoQuotes online catalog for foodservice equipment and supplies.[21] Because it is common knowledge that dealers do not pay the published list prices for equipment, it was necessary apply a discount factor to the AutoQuotes data to more accurately reflect the actual prices paid for the equipment. The discount factor of 50% was based upon professional judgement by Food Service Technology Center (FSTC) staff. Additional analysis to validate the reasonableness of this value was conducted by comparing AutoQuotes published prices with actual prices on invoices submitted through the Southern California Gas Company Instant Rebates! point-of-sale rebate program from 2015 through August of 2017.[22] This verification revealed that a "list-to-actual" cost ratio for food service equipment of 50% is a reasonable average discount factor.

BASE CASE LABOR COST ($/UNIT)

The base case labor cost for equipment *delivered via direct install* is equal to $0.

For *all other delivery types*, a high efficiency model does not require additional installation labor compared to a base case model unless infrastructure cost are needed due to fuel substitution. Since this measure is applicable for normal replacement installations, the base case and measure case model installation costs are expected to be the same for the customer and thus were not estimated for the incremental cost analysis.

MEASURE CASE LABOR COST ($/UNIT)

The measure case labor cost for equipment *delivered via direct install* will be derived as the average installation cost submitted by one or more implementation contractors. The actual installation cost can vary by contractor, the date when the work occurred, and by the volume of each specific contractor's business. Contractor costs are confidential information and are based upon contractually agreed upon pricing as established in their purchase order with the program administrator. Therefore, the program

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[19] Food Service Technology Center (FSTC). 2016. "Fryer 2016 Price Updates.xlsx."

[20] Energy Solutions. 2017. "2016 IMC Analysis - For Cal TF (Energy Solutions).xls."

[21] Food Service Technology Center (FSTC). 2016. "Fryer 2016 Price Updates.xlsx."

[22] Energy Solutions. 2017. "2016 IMC Analysis - For Cal TF (Energy Solutions).xls."

administrator program tracking systems are the only source for the labor installation cost data. The program administrator will utilize the actual program cost to evaluate the cost-effectiveness of the measure.

For *all other delivery types*, a high efficiency model does not require additional installation labor compared to a base case model unless infrastructure cost are needed due to fuel substitution. Since this measure is applicable for normal replacement installations, the base case and measure case model installation costs are expected to be the same for the customer and thus were not estimated for the incremental cost analysis.

Additional infrastructure cost may occur because a commercial kitchen will likely have necessary breakers and plugs to operate 240v equipment but may require additional electrical wiring and outlets. The estimated cost for additional wiring, conduit, outlets and installation labor is $400. This infrastructure cost is estimated for informational purposes only and is not included as part of the labor or measure cost. Infrastructure cost will be gathered as part of program implementation.

NET-TO-GROSS (NTG)

The net-to-gross (NTG) ratio represents the portion of gross impacts that are determined to be directly attributed to a specific program intervention. The NTG for fuel substitution measures was stipulated in Decision 19-08-009, *Decision Modifying the Energy Efficiency Three-Prong Test Related to Fuel Substitution,* issued by the California Public Utilities Commission (CPUC).[23] "When a fuel substitution measure passes the Fuel Substitution Test, it shall be included in the cost-effectiveness analysis of the portfolio with a net-to-gross (NTG) ratio assumption of 1.0, until such time as evaluated NTG information is available, when the assumption shall be updated on a prospective basis." (OP 1)

Net-to-Gross Ratios

Parameter	Value	Source
NTG – FuelSubst-Default	1.0	California Public Utilities Commission. 2019. Decision 19-06-008. And California Public Utilities Commission. 2019. Fuel Substitution Technical Guidance for Energy Efficiency.

GROSS SAVINGS INSTALLATION ADJUSTMENT (GSIA)

The gross savings installation adjustment (GSIA) rate represents the ratio of the number of verified installations of the measure to the number of claimed installations reported by the utility. This factor varies by end use, sector, technology, application, and delivery method. This GSIA rate is the current "default" rate specified for measures for which an alternative GSIA has not been estimated and approved.

[23] California Public Utilities Commission. 2019. "Fuel Substitution Technical Guidance for Energy Efficiency".

Gross Savings Installation Adjustment Rate

Parameter	Value	Source
GSIA	1.0	California Public Utilities Commission (CPUC), Energy Division. 2013. *Energy Efficiency Policy Manual Version 5*. Page 31.

NON-ENERGY IMPACTS

Non-energy impacts for this measure have not been quantified.

DEER DIFFERENCES ANALYSIS

The table below summarizes the inputs and methods that are and are not based upon the Database for Energy Efficient Resources (DEER).

DEER Difference Summary

DEER Item	Comment / Used for Workpaper
Modified DEER methodology	No
Scaled DEER measure	No
DEER Base Case	No
DEER Measure Case	No
DEER Building Types	Yes
DEER Operating Hours	No
DEER eQUEST Prototypes	No
DEER Version	n/a
Reason for Deviation from DEER	DEER 2014 does not contain these measures.
DEER Measure IDs Used	n/a
NTG	Source: DEER. The NTG of 1.0 is associated with NTG ID: FuelSubst-Default
GSIA	Source: DEER. The value of 1.0 is associated with GSIA ID: *Def-GSIA*
EUL/RUL	Source: DEER 2014 / 2016. The value of 12 years is associated with EUL ID: *Cook-GasFryer* and *Cook- ElecFryer*.

REVISION HISTORY

Measure Characterization Revision History

Revision Number	Revision Complete Date	Primary Author, Title, Organization	Revision Summary
01	5/5/2019	Keith Valenzuela AESC Inc.	Gas to Electric Fuel Substitution based on SWFS011-02 Commercial Fryer