



**eTRM**  
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**FOOD SERVICE**  
**COMMERCIAL CONVECTION OVEN –**  
**ELECTRIC & GAS**  
SWFS001-02

**C O N T E N T S**

Measure Name ..... 2  
Statewide Measure ID..... 2  
Technology Summary ..... 2  
Measure Case Description ..... 2  
Base Case Description..... 2  
Code Requirements ..... 4  
Normalizing Unit..... 5  
Program Requirements..... 5  
Program Exclusions..... 6  
Data Collection Requirements ..... 5  
Use Category..... 5  
Electric Savings (kWh)..... 6  
Peak Electric Demand Reduction (kW) ..... 10  
Gas Savings (Therms) ..... 11  
Life Cycle..... 12  
Base Case Material Cost (\$/unit) ..... 15  
Measure Case Material Cost (\$/unit)..... 15  
Base Case Labor Cost (\$/unit) ..... 13  
Measure Case Labor Cost (\$/unit) ..... 13  
Net-to-Gross (NTG) ..... 16  
Gross Savings Installation Adjustment (GSIA) ..... 14  
Non-Energy Impacts ..... 14  
DEER Differences Analysis..... 17  
Revision History ..... 18

## MEASURE NAME

Commercial Convection Oven – Electric & Gas

## STATEWIDE MEASURE ID

SWFS001-02

## TECHNOLOGY SUMMARY

Commercial convection ovens are one of the most widely used appliances in the food service industry. Many food service operations rely heavily on the versatility of ovens; operators can cook varieties of foods in large quantities with a single appliance. This product diversity means that ovens are utilized in almost any type of food service operation.

Convection oven performance is determined by the American Society for Testing and Materials (ASTM) Standard Test Method for the Performance of Convection Ovens (F1496).<sup>1</sup> The ASTM Standard Test Method is the industry standard for quantifying the energy consumption, efficiency, and cooking performance of convection ovens based on testing in an approved and qualified laboratory.

## MEASURE CASE DESCRIPTION

The measure case specification accounts for the idle energy rate, cooking energy efficiency rate, and production capacity of a convection oven. These represent the results of the convection oven study<sup>2</sup> conducted per the CPUC disposition<sup>3</sup> which includes testing data from the Food Service Technology Center & Food Service Testing Lab (SoCalGas), rebate participant survey, industry standard practice study, field data monitoring, and reviews of the California Energy Commission database and the Energy Star certified equipment.

### Measure Case Specification for Commercial Convection Ovens

Oven Type		Idle Energy Rate	Cooking Energy Efficiency	Production Capacity (lb/hr)	Source
Electric	Half-Size	756 W	76%	49	The Southern California Gas Company (SCG). 2019. "Update Plan_Conv Oven_12292019.xlsx"
	Full-Size	1,353 W	76%	93	
Gas	Half-Size	4,293 Btu/hr	53%	47	
	Full-Size	9,349 Btu/hr	51%	90	

\* Half-size gas convection oven specification is based on the test result of one model due to the limited availability.

<sup>1</sup> American Society for Testing and Materials (ASTM). 2013. *ASTM F1496-13, Standard Test Method for the Performance of Convection Ovens*. West Conshohocken (PA): ASTM International.

<sup>2</sup> The Southern California Gas Company (SCG). 2019. "Update Plan\_Conv Oven\_12292019.xlsx."

<sup>3</sup> Biermayer, P. (CPUC, Energy Division). 2019. "Non-standard Disposition for the convection oven workpaper SWFS001-01." Memorandum to Henry Liu (PG&E). January 4

## BASE CASE DESCRIPTION

The base case specification accounts for the idle energy rate, cooking energy efficiency rate, and production capacity of a convection oven. In the absence of mandatory state and federal regulations for commercial ovens, there is little incentive on the part of equipment manufacturers to test their baseline equipment. As such, the parameters for base case equipment were derived from results of a sample of low efficiency equipment tested by the Food Service Technology Center (FSTC) & Food Service Testing Lab (FSTL, SoCalGas). Cooking energy efficiency and production capacity are based upon the heavy-load potato test in American Society for Testing and Materials (ASTM) Standard Test Method for the Performance of Convection Ovens (F1496).<sup>4</sup>

### Base Case Specifications for Commercial Convection Ovens

Oven Type		Idle Energy Rate	Cooking Energy Efficiency	Production Capacity (lb/hr)	Source
Electric	Half-Size	1,510 W	64%	45	The Southern California Gas Company (SCG). 2019. "Update Plan_Conv Oven_12292019.xlsx"
	Full-Size	1,988 W	71%	88	
Gas	Half-Size	8,000 Btu/hr	42%	45	
	Full-Size	16,425 Btu/hr	41%	85	

\* Half-size gas convection oven specification is based on the test result of one model due to the limited availability.

## CODE REQUIREMENTS

This measure is not governed by either state or federal codes and standards. The California 2014 Appliance Efficiency Regulations (Title 20)<sup>5</sup> requires that manufacturers report the convection oven idle energy rate per ASTM F1496 for the California Energy Commission (CEC) certified appliance database,<sup>6</sup> but the standard does not specify the minimum performance requirement.

### Applicable State and Federal Codes and Standards

Code	Applicable Code Reference	Effective Date
CA Appliance Efficiency Regulations – Title 20	None.	n/a
CA Building Energy Efficiency Standards – Title 24	None.	n/a
Federal Standards	None.	n/a

<sup>4</sup> American Society for Testing and Materials (ASTM). 2013. *ASTM F1496-13, Standard Test Method for the Performance of Convection Ovens*. West Conshohocken (PA): ASTM International.

<sup>5</sup> California Energy Commission (CEC). 2014. *2014 Appliance Efficiency Regulations*. CEC-400-2014-009-CMF.

<sup>6</sup> California Energy Commission (CEC). (n.d.) "Modernized Appliance Efficiency Database System (MAEDBS)." <http://www.energy.ca.gov/appliances/>.

Convection oven performance is determined by applying the American Society for Testing and Materials (ASTM) Standard Test Method for the Performance of Convection Ovens (F1496).<sup>7</sup> The ASTM Standard Test Method is the industry standard for quantifying the energy consumption, efficiency, and cooking performance of convection ovens based on testing in an approved and qualified laboratory.

## NORMALIZING UNIT

Each

## PROGRAM REQUIREMENTS

### *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.

*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
New construction	UpDeemed	Ag
New construction	UpDeemed	Ind
New construction	UpDeemed	Com
New construction	DnDeemed	Ag
New construction	DnDeemed	Ind
New construction	DnDeemed	Com
New construction	DnDeemDI	Ag
New construction	DnDeemDI	Ind

<sup>7</sup> American Society for Testing and Materials (ASTM). 2013. *ASTM F1496-13, Standard Test Method for the Performance of Convection Ovens*. West Conshohocken (PA): ASTM International.

Measure Application Type	Delivery Type	Sector
New construction	DnDeemDI	Com

*Eligible Products*

All qualifying convection oven models must be approved and listed in the California Energy Commission (CEC) certified appliance database<sup>8</sup> or must meet the ENERGY STAR Version 2.2 eligibility criteria.

**Energy Efficiency Requirements of Commercial Convection Ovens**

Oven Type		Max. Idle Energy Rate	Min. Cooking Energy Efficiency	Source
Electric	Half-Size	1.0 kW	71%	ENERGY STAR. 2015. "Commercial Oven Key Product Criteria Version 2.2."
	Full-Size	1.6 kW	71%	
Gas	Half-Size	N/A	N/A	
	Full-Size	12,000 Btu/hr	46%	

\* Half-size gas convection ovens are excluded from ENERGY STAR.

*Eligible Building Types and Vintages*

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

*Eligible Climate Zones*

This measure is applicable for installation in any California climate zone.

**PROGRAM EXCLUSIONS**

Used or rebuilt equipment is not eligible. Half-size gas convection is not eligible.

**DATA COLLECTION REQUIREMENTS**

This revision incorporated the analysis of data collected from equipment tests, IOU rebates, CEC/ENERGY STAR database, surveys, and interviews with experts in the industry. Additional updates can be made when more baseline equipment data become available. Especially, half-size gas model availability is currently limited in the market, and more data needs to be acquired when it becomes more readily available.

**USE CATEGORY**

Food service (FoodServ)

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<sup>8</sup> California Energy Commission (CEC). (n.d.) "Modernized Appliance Efficiency Database System (MAEDBS)." <http://www.energy.ca.gov/appliances/>.

## ELECTRIC SAVINGS (kWh)

The annual unit energy saving (UES) is calculated as the difference between the measure case UEC and the base case UEC.

### 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.

$$UEC\_DAY = \text{cooking energy} + \text{idle energy} + \text{preheat energy}$$

**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.

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

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

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

$$\text{preheat energy} = (nP \times EP)$$

<i>nP</i> =	<i>Estimated number of preheats per day (#)</i>
<i>EP</i> =	<i>Measured preheat energy (kWh)</i>

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

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

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

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

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

<i>UEC\_DAY</i> =	<i>Daily unit energy consumption (kWh)</i>
<i>EDAYS</i> =	<i>Estimated operating days per year (days)</i>



### Annual Electric Unit Energy Savings

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

$$UES_{YEAR} = [UEC_{YEAR_{Base}} - UEC_{YEAR_{Measure}}] \times (1 - CPUCFactor)$$

$UEC_{YEAR} =$  Annual UEC, baseline or measure (kWh/year)  
 $UES_{YEAR} =$  Annual UES (kWh/year)

### Inputs and Assumptions

The inputs for the calculation of the UES of half-size and full-size electric convection ovens are specified below. The source of each of assumed values are specified in the referenced calculation file<sup>2</sup>. The ASTM Energy to Food ratio is the average value calculated by FSTC through ASTM F1496 test through weight and temperature measurement of test product cooked in convection ovens (250 Btu/lb for russet potato).

#### Electric UEC Inputs - Half-Size Convection Oven

Parameter	Base Case Model	Measure Case Model	Source
Number of Preheats/Day	1	1	The Southern California Gas Company (SCG). 2019. "Update Plan_Conv Oven_12292019.xlsx"
Preheat Time (minutes)	8.5	7.7	
Preheat Energy (kWh)	0.89	0.70	
Idle Energy Rate (kW)	1.51	0.76	
Heavy Load Cooking Energy Efficiency (%)	64%	76%	
Production Capacity (lb/hr)	45	49	
Pounds of Food Cooked/Day (lb)	122	122	
ASTM Energy to Food (Btu/lb)	250	250	
Operating Hours/Day (hours)	9.9	9.9	
Operating Days/Year (days)	270	270	

#### Electric Energy Use Inputs - Full-Size Convection Oven

Parameter	Base Case Model	Measure Case Model	Source
Number of Preheats/Day	1	1	The Southern California Gas Company (SCG). 2019. "Update Plan_Conv Oven_12292019.xlsx"
Preheat Time (minutes)	8.8	8.5	
Preheat Energy (kWh)	1.56	1.39	
Idle Energy Rate (kW)	1.99	1.35	
Heavy Load Cooking Energy Efficiency (%)	71%	76%	
Production Capacity (lb/hr)	88	93	
Pounds of Food Cooked/Day (lb)	122	122	
ASTM Energy to Food (Btu/lb)	250	250	
Operating Hours/Day (hours)	9.9	9.9	
Operating Days/Year (days)	270	270	

A sample calculation of daily and annual UEC of a base case full-size electric convection oven is provided below.

$$\text{Convection cooking energy} = \left[ \frac{122 \times 249.8 \times \frac{1}{3412.14}}{0.71} \right] = 12.60 \text{ kWh}$$

$$\text{Convection idle energy} = \left[ 1.988 \times \left( 9.9 - \frac{122}{88} - (1 \times 8.8/60) \right) \right] = 16.58 \text{ kWh}$$

$$\text{Preheat energy} = (1 \times 1.56) = 1.56 \text{ kWh}$$

$$\text{UEC}_{\text{Day}} = 12.60 + 16.58 + 1.56 = 30.74 \text{ kWh/day}$$

$$\text{UEC}_{\text{Year}} = 30.74 \text{ kWh/day} \times 270.3 \text{ days/yr} = 8,309 \text{ kWh/yr}$$

### PEAK ELECTRIC DEMAND REDUCTION (KW)

The actual contribution to a building peak demand may vary significantly depending on the oven usage pattern in relation to that of other electric equipment in the facility (operating schedule, appliance ON time, etc.). The probability of an appliance drawing its average rate during the period of the building peak is significantly higher than for any other input rate for that appliance.

### Peak Demand Reduction Calculation

It is assumed that this measure operates within the Database of Energy Efficient Resources (DEER) peak period of 4 p.m. to 9 p.m. on weekdays<sup>9</sup> at a constant load throughout the day. The average and peak demand reduction calculations utilize the measured data of base case and measure case convection ovens specified for Electric Savings. The average demand (baseline or measure case) is equal to the annual unit energy consumption (UEC) divided by the assumed annual hours of operation.

$$\text{Demand}_{\text{avg}} = \frac{\text{UEC}_{\text{YEAR}} \text{ kWh}}{\text{EDAYS} \times \text{E HOUR}}$$

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

*EDAYS* = Estimated operating days per year (days)

*E HOUR* = Estimated operating hours per day (hrs)

The average demand reduction is the difference between the baseline and measure case average demand. The estimated peak demand reduction is calculated as the average demand reduction multiplied by the coincident demand factor (CDF).

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<sup>9</sup> California Public Utilities Commission (CPUC). 2018. *Resolution E-4952*. October 11. Op 1.

Note that for measures implemented through investor-owned utility (IOU) portfolios, the calculation of the peak demand reduction includes an adjustment factor as per Decision 11-07-030,<sup>10</sup> which states “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.” The final peak demand claimable by an IOU is therefore reduced by 30%.

$$\text{PeakDemandReduction} = [(Demand_{avg,base} - Demand_{avg,measure}) \times CDF]$$

$Demand_{avg} =$  Average demand, base or measure case (kW)

$CDF =$  Coincident demand factor

### Inputs and Assumptions

The table below provides the inputs for the calculation of peak demand reduction of a commercial convection oven.

#### Demand Reduction Inputs (all sizes)

Parameter	Value	Source
Coincident Demand Factor	0.90	Itron, Inc. 2005. <i>2004-2005 Database for Energy Efficiency Resources (DEER) Update Study - Final Report</i> . Prepared for Southern California Edison. Pages 3-15 to 3-17, Table 3-14.

### 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).

#### Annual Gas Unit Energy Consumption

As shown below, the daily UEC (baseline or measure case, all oven sizes) is equal to the sum of the energy required for cooking, preheat, and idle modes of operation.<sup>11</sup> These calculations and the inputs are provided below

$$UEC_{DAY} = \text{convection cooking energy} + \text{convection idle energy} + \text{preheat energy}$$

**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.

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

<sup>10</sup> California Public Utilities Commission (CPUC). 2011. D 11-07-030 in the Consolidated Application of Southern California Edison Company (U338E) for Approval of its 2009-2011 Energy Efficiency Program Plan and Associated Public Goods Charge (PGC) and Procurement Funding Requests. And Related Matters. (A.08-07-021). Issued July 14, 2011. Attachment A, page A4.

<sup>11</sup> American Society for Testing and Materials (ASTM). 2013. *ASTM F1496-13, Standard Test Method for the Performance of Convection Ovens*. West Conshohocken (PA): ASTM International.

*LBFOOD* = Estimated pounds of food cooked per day  
*EFOOD* = ASTM energy to food (Btu/lb) = Btu/pound of energy absorbed by food product during cooking based on ASTM F1496  
*EFFICIENCY* = Measured heavy load cooking energy efficiency %

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

$$\text{preheat energy} = (nP \times EP)$$

*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.

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

*IDLE RATE* = Measured idle energy rate (Btu)  
*EHOURL* = 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.

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

*UEC\\_DAY* = Calculated daily energy consumption (Btu/day)  
*EDAYS* = Estimated operating days per year (days)  
*BtuTherm* = Btu to therm conversion factor

### Annual Gas Unit Energy Savings

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

$$\text{UES}_{\text{YEAR}} = [\text{UEC\_YEAR}_{\text{Base}} - \text{UEC\_YEAR}_{\text{Measure}}]$$

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

### Inputs and Assumptions

The inputs for the calculation of the UES of half-size and full-size gas convection ovens are specified below. The source of each of assumed values is specified in the referenced calculation file<sup>2</sup>. The ASTM Energy to Food ratio is the average value calculated by FSTC through ASTM F1496 test through weight and temperature measurement of test product cooked in convection ovens (250 Btu/lb for russet potato).

**Gas UEC Inputs - Half-Size Convection Oven**

Parameter	Base Case Model	Measure Case Model	Source
Number of Preheats per Day	1	1	The Southern California Gas Company (SCG). 2019. "Update Plan_Conv Oven_12292019.xlsx"
Preheat Time (minutes)	12.4	8.5	
Preheat Energy (Btu)	6,000	3,375	
Idle Energy Rate (Btu/hr)	8,000	4,293	
Heavy Load Cooking Energy Efficiency (%)	42%	53%	
Production Capacity (lb/hr)	36	47	
Pounds of Food Cooked per Day	122	122	
ASTM Energy to Food (Btu/lb)	250	250	
Operating Hours/Day	9.9	9.9	
Operating Days/Year	270	270	

**Gas Energy Use Inputs - Full-Size Convection Oven**

Parameter	Base Case Model	Measure Case Model	Source
Number of Preheats per Day	1	1	The Southern California Gas Company (SCG). 2019. "Update Plan_Conv Oven_12292019.xlsx"
Preheat Time (minutes)	11.7	10.8	
Preheat Energy (Btu)	13,096	9,449	
Idle Energy Rate (Btu/hr)	16,425	9,349	
Heavy Load Cooking Energy Efficiency (%)	41%	51%	
Production Capacity (lb/hr)	85	90	
Pounds of Food Cooked per Day	122	122	
ASTM Energy to Food (Btu/lb)	250	250	
Operating Hours/Day	9.9	9.9	
Operating Days/Year	270	270	

A sample calculation of the daily and annual UEC of a base case half-size model is provided below.

$$UEC_{Day} = 74,102 + 135,214 + 13,096 = 222,411 \text{ Btu /day}$$

$$convection \ cooking \ energy = \left[ \frac{122 \times 250}{0.41} \right] = 74,102 \text{ Btu}$$

$$convection \ idle \ energy = \left[ 16,425 \times \left( 9.9 - \frac{122}{85} - (1 \times 11.7/60) \right) \right] = 135,214 \text{ Btu}$$

$$preheat \ energy = (1 \times 13,096) = 13,096 \text{ Btu}$$

$$Annual \ Energy \ Consumption = \frac{222,411 \text{ Btu}}{1 \text{ day}} \times 270 \text{ days} \times \frac{1 \text{ therm}}{100,000 \text{ Btu}}$$

$$UEC_{Year} = 769 \text{ therms/year}$$



## 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. EUL is often, but not always, derived from measure persistence or retention studies. 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 the commercial convection oven is presented below. Note that RUL is only applicable for add-on equipment and accelerated measures and is not applicable for this measure.

### Effective Useful Life and Remaining Useful Life

Parameter	Value	Source
EUL (yrs)	12	Robert Mowris & Associates. 2005. <i>Ninth Year Retention Study of the 1995 Southern California Gas Company Commercial New Construction Program</i> . Prepared for Southern California Gas Company. Study ID Number 718A.  California Public Utilities Commission (CPUC), Energy Division. 2003. <i>Energy Efficiency Policy Manual v 2.0</i> . 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 derived as the average of the manufacturer published list prices for electric and gas convection ovens retrieved from the AutoQuotes online catalog for foodservice equipment and supplies.<sup>12</sup> Because it is common knowledge that dealers do not pay the published list prices for equipment, it was necessary to 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 compared 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.<sup>13</sup> 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 costs for *all delivery types* were derived as the average of the manufacturer list prices for energy efficient electric and gas convection ovens retrieved from the AutoQuotes online catalog for foodservice equipment and supplies.<sup>14</sup> Because it is common knowledge that dealers do not

<sup>12</sup> Food Service Technology Center (FSTC). 2016. “Ovens 2016 Price Updates.xlsx.”

<sup>13</sup> Energy Solutions. 2017. “2016 IMC Analysis - For Cal TF (Energy Solutions).xls.”

<sup>14</sup> Food Service Technology Center (FSTC). 2016. “Ovens 2016 Price Updates.xlsx.”

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 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.<sup>15</sup> 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*, 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 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. Since this measure is applicable for normal replacement and new construction installations, the base case and measure case model installation costs are expected to be the same for the customer and thus not estimated for the incremental cost analysis.

### 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. These NTG values are based upon the average of all NTG ratios for all evaluated 2006 – 2008 commercial, industrial, and agriculture programs, as documented in the 2011 DEER Update Study conducted by Itron, Inc. These sector average NTGs (“default NTGs”) are applicable to all energy efficiency measures that have been offered through commercial, industrial, and agriculture sector programs for more than two years and for which impact evaluation results are not available.

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<sup>15</sup> Energy Solutions. 2017. "2016 IMC Analysis - For Cal TF (Energy Solutions).xls."

**Net-to-Gross Ratios**

Parameter	Commercial Convection Oven – Electric	Commercial Convection Oven – Gas	Source
NTG – Commercial	0.60	0.60	Itron, Inc. 2011. <i>DEER Database 2011 Update Documentation</i> . Prepared for the California Public Utilities Commission. Page 15-4 Table 15-3.
NTG – Industrial	0.60	0.60	
NTG - Agriculture	0.60	0.60	

**GROSS SAVINGS INSTALLATION ADJUSTMENT (GSIA)**

The gross savings installation adjustment (GSIA) 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.

**Gross Savings Installation Adjustment Rate**

Parameter	Value	Source
GSIA	1.0	California Public Utilities Commission (CPUC), Energy Division. 2013. <i>Energy Efficiency Policy Manual Version 5</i> . 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	n/a
DEER Measure Case	n/a
DEER Building Types	n/a
DEER Operating Hours	n/a
DEER eQUEST Prototypes	n/a
DEER Version	n/a
Reason for Deviation from DEER	DEER does not contain information on energy use or savings for an energy-efficient electric or gas commercial convection oven measure.
DEER Measure IDs Used	n/a
NTG	Source: DEER 2016. NTG of 0.60 is associated with NTG ID: <i>Com-Default&gt;2yrs, Ag-Default&gt;2yrs, Ind-Default&gt;2yrs</i>
GSIA	Source: DEER 2016. The value of 1.0 is associated with GSIA ID: <i>Def-GSIA</i>

DEER Item	Comment / Used for Workpaper
EUL/RUL	Source: DEER 2016. The EUL of 12 years is associated with EUL ID: <i>Cook-ElecConv</i> and <i>Cook-GasConvOven</i>

## REVISION HISTORY

### Measure Characterization Revision History

Revision Number	Revision Complete Date	Primary Author, Title, Organization	Revision Summary and Rationale for Revision
01	07/31/2018	Jennifer Holmes Cal TF Staff	Draft of consolidated text for this statewide measure is based upon: SCE13CC011 Revision 4 (October 17, 2016) PGECOFST101 Revision 6 (August 2016) WPSDGENRCC0006 Revision 3 (June 27, 2014) Consensus reached among Cal TF members.
	10/9/2018 10/30/2018	Jennifer Holmes Cal TF Staff	Completed final revisions for submittal of version 01.
02	10/1/2019	Andres Marquez SoCalGas	Updated ENERGY STAR requirements table “Energy Efficiency Requirements of Commercial Convection Ovens” Updated Full-size Preheat Energy, Idle Energy, Cooking efficiency, Production capacity, operating hours, and operating day per year per attachment A from “Foodservice Secondary Source_draft_08/29/2019” for both electric and gas ovens ISP study and test data were gathered to update gas measure case, gas base case as well as gas calculation assumptions to reflect direction given by CPUC in disposition “Non-standard Disposition for the convection oven workpaper SWFS001-01”
	12/30/2019	Chan Paek SoCalGas	Updated calculations based on CPUC’s review comments and the referenced worksheet “Update Plan_Conv Oven_12292019.xlsx.”
	01/05/2020	Chan Paek SoCalGas	Corrected typographical errors and added clarifications on half-size gas oven data per ED review feedback. No change in DataSpec file or EAD tables.