



**WATERHEATING
BOILER, PROCESS
SWWH008-01**

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MEASURE NAME

Boiler, Process

STATEWIDE MEASURE ID

SWWH008-01

TECHNOLOGY SUMMARY

A process boiler is a pressure vessel that transfer heat to water for manufacturing. In most boilers, a heat exchanger separates the combustion products from the water. Boilers can be configured as an integrated packaged boiler, or, in some cases, the boiler (which may resemble an instantaneous water heater) may be connected to a separate tank that contains an internal heat exchanger. An energy efficient unit may have one or more of the following features: forced air burner, relatively large heat exchange surface, and/or economizer to utilize heat recovery from stack gases.

MEASURE CASE DESCRIPTION

The measure case is defined as the replacement of standard efficiency process boiler with a high-efficiency process boiler. The measure offerings are specified below. Savings are calculated by climate zone for each measure offering.

Measure Case Specification

Boiler Type	Input Rating (kBtu/hr)	Min. Qualifying Combustion Efficiency (CE)
Water Process Boiler – Tier 1	< 200,000	85.0%
Water Process Boiler – Tier 2		90.0%
Steam Process Boiler		83.0%

The analysis for this measure assumes the following:

- The measure case boiler has the same input rating (measured in kBtu/hr) as the unit being replaced.
- Both base case and measure case boilers deliver the same amount of hot water or steam on an annual basis (i.e., customer demand for hot water or steam does not change).

BASE CASE DESCRIPTION

The base case is defined as a standard efficiency process water or steam boiler, as specified below. Base case efficiencies are based on 2013 California Building Energy Efficiency Standards (Title 24) minimum efficiencies for boilers. (See Code Requirements.)



Base Case Specification

Base Case	Combustion Efficiency (CE)	Source
Water Process Boiler	82.0%	California Energy Commission (CEC). 2012. <i>2013 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24)</i> . CEC-4002012-004-CMF-REV2. Table
Steam Process Boiler	80.0%	Derived as noted.

Title 24 requires large water boilers to have a minimum combustion efficiency of 82% and large steam boilers to have a minimum thermal efficiency of 79%. While Title 24 is targeted specifically to space conditioning equipment, the more stringent code regulations are utilized for this measure analysis. In addition, because Title 24 evaluates steam boilers in TE, the combustion efficiency (CE) of a water boiler was adjusted to estimate the CE of a steam boiler. In particular, the CE for a steam boiler was adjusted based upon the U.S. Department of Energy (DOE) Steam Tip Sheet #4.¹ The CE of a steam boiler is assumed to be 2% less efficient than a comparable water boiler, assuming a 3% excess oxygen level and flue gas temperatures of ≥ 100 °F higher than a similarly sized water boiler. Therefore, the Title 24 minimum CE of a large water boiler was adjusted by 2% to derive the minimum CE for a large steam boiler.

CODE REQUIREMENTS

Applicable state and federal codes and standards for process boilers are provided in the table below, followed by the applicable California Appliance Efficiency Standards (Title 20)² and Building Energy Efficiency Standards (Title 24).³

¹ U.S. Department of Energy (DOE), Energy Efficiency & Renewable Energy, Advanced Manufacturing Office. 2012. "Energy Tips: STEAM." DOE/GO-102012-3405.

² California Energy Commission (CEC). 2015. *2015 Appliance Efficiency Regulations*. CEC 400-2015-021. Section 1605.1(e), Table E-4.

³ California Energy Commission (CEC). 2012. *2013 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24)*. CEC-400-2012-004-CMF-REV2. Section 110 Table 110.2(k).

Applicable State and Federal Codes and Standards for Process Boilers

Code	Applicable Code Reference	Effective Date
CA Appliance Efficiency Regulations – Title 20 (2015)	Section 1605.1(f)	July 1, 2014
CA Building Energy Efficiency Standards – Title 24 (2013)	Section 110.2(k)	July 1, 2014
Federal Standards	None.	n/a

California Appliance Efficiency Regulations (Title 20) for Packaged Boilers ≥ 300,000 Btu/hr

Appliance	Type	Rated Input (Btu/hr)	Minimum Efficiency (%)			
			Combustion Efficiency %		Thermal Efficiency%	
			January 1 1994 through March 1, 2012	March 2, 2012	March 2, 2012 through March 1, 2022	March 2, 2022
Hot Water Boilers	Gas-fired	≥ 300,000 and ≤ 2,500,000	80	–	80	80
		> 2,500,000		82	–	–
	Oil-fired	≥ 300,000 and ≤ 2,500,000	83	–	82	82
		> 2,500,000		84	–	–
Steam Boilers	Gas-fired, except natural draft	≥ 300,000 and ≤ 2,500,000	80	–	79	79
		> 2,500,000		–		
	Gas-fired, natural draft	≥ 300,000 and ≤ 2,500,000	80	–	77	79
		> 2,500,000		–		
	Oil-fired	≥ 300,000 and ≤ 2,500,000	83	–	81	81
		> 2,500,000		–		

Title 24 states:

Any space-conditioning equipment listed in this section may be installed only if the manufacturer has certified to the Commission that the equipment complies with all the applicable requirements of this section.

(a) Efficiency. Equipment shall meet the applicable efficiency requirements in TABLE 110.2-A through TABLE 110.2- K subject to the following:

- 1. If more than one efficiency standard is listed for any equipment in TABLE 110.2-A through TABLE 110.2-K, the equipment shall meet all the applicable standards that are listed; and*
- 2. If more than one test method is listed in TABLE 110.2-A through TABLE 110.2-K, the equipment shall comply with the applicable efficiency standards when tested with each listed test method; and*
- 3. Where equipment can serve more than one function, such as both heating and cooling, or both space heating and water heating, it shall comply with all the efficiency standards applicable to each function; and*
- 4. Where a requirement is for equipment rated at its "maximum rated capacity" or "minimum rated capacity," the capacity shall be as provided for and allowed by the controls, during steady-state operation.*



The California Building Energy Efficiency Standards (Title 24) minimum efficiency requirements for gas- and oil-fired boilers⁴ are provided below.

California Building Efficiency Standards (Title 24) for Gas- and Oil-Fired Boilers

Equipment Type	Sub Category	Size Category (Input)	Minimum Efficiency ^{b,c}	Test Procedure ^a
Boiler, hot water	Gas-Fired	< 300,000 Btu/h	82% AFUE	DOE 10 CFR Part 430
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^d	80% E _t	DOE 10 CFR Part 431
		> 2,500,000 Btu/h ^e	82% E _c	
	Oil-Fired	< 300,000 Btu/h	84% AFUE	DOE 10 CFR Part 430
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^d	82% E _t	DOE 10 CFR Part 431
		> 2,500,000 Btu/h ^e	84% E _c	
Boiler, steam	Gas-Fired	< 300,000 Btu/h	80% AFUE	DOE 10 CFR Part 430
	Gas-Fired all, except natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^d	79% E _t	DOE 10 CFR Part 431
		> 2,500,000 Btu/h ^e	79% E _t	DOE 10 CFR Part 431
	Gas-Fired, natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^d	77% E _t	DOE 10 CFR Part 431
		> 2,500,000 Btu/h ^e	77% E _t	DOE 10 CFR Part 431
	Oil-Fired	< 300,000 Btu/h	82% AFUE	DOE 10 CFR Part 430
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^d	81% E _t	DOE 10 CFR Part 431
		> 2,500,000 Btu/h ^e	81% E _t	DOE 10 CFR Part 431
	^a Applicable test procedure and reference year are provided under the definitions. ^b E _c = combustion efficiency (100% less flue losses) .See reference document for detailed information. ^c E _t = thermal efficiency. See test procedure for detailed information. ^d Maximum capacity - minimum and maximum ratings as provided for and allowed by the unit's controls. ^e Included oil-fired (residual).			

NORMALIZING UNIT

The normalizing unit is per kBtu/hr of rated input capacity (cap-kBtu/h)

⁴ California Energy Commission (CEC). 2012. 2013 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24). CEC-400-2012-004-CMF-REV2. Section 110 Table 110.2(k).



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

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

Eligible Products

Water boilers must have an input rating $\leq 200,000$ kBtu/hr. The combustion efficiency must have a documented combustion efficiency of 85% or greater under full load conditions.

Steam boilers must have an input rating $\leq 200,000$ kBtu/hr. The combustion efficiency must have a documented combustion efficiency of 83% or greater under full load conditions.

Eligible Building Types

Eligible building types include all existing commercial, agriculture, and industrial (nonresidential) buildings of any vintage.

This measure is available to industrial end-use customers that manufacture a saleable product, typically (but not limited to) NAICS codes 31, 32 and 33.

Eligible Climate Zones

The measure is applicable in all California climate zones.



PROGRAM EXCLUSIONS

This measure is not applicable to boilers used for space heating, domestic hot water, pools, or spas, and is not eligible for domestic hot water or space heating.

This measure is not eligible for new construction installations.

DATA COLLECTION REQUIREMENTS

Data collection requirements are to be determined.

USE CATEGORY

Process heat (ProcHeat)

ELECTRIC SAVINGS (kWh)

Not applicable.

PEAK ELECTRIC DEMAND REDUCTION (kW)

Not applicable.

GAS SAVINGS (Therms)

The calculation of gas unit energy savings (UES) from the installation of an energy efficient process boiler is represented by the equation below. The UES (therms per kBtu/hr) is based on the difference between the annual gas unit energy consumption (UEC) of the base case and the measure case boilers. This methodology assumes that the new process boiler has the same input rating (kBtu/hr) as the unit being replaced and that both units (the base and measure case unit) deliver the same amount of hot water or steam on an annual basis (i.e., customer demand for hot water or steam does not change).

$$UES = UEC_{base} - UEC_{measure}$$

UES =	Unit energy savings, therms/kBtu/hr input rating
UEC _{base} =	Unit energy consumption, base case, therms/kBtu/hr input rating
UEC _{measure} =	Unit energy consumption, measure case, therms/kBtu/hr input rating

Base case annual gas UEC is based on the average capacity factor and operating hours, as shown below.

$$UEC_{base} = CF_{avg} \times H \times C$$

CF _{avg} =	Average capacity factor across all industries, no units
H =	Annual operating hours, hr/yr
C =	Conversion factor for therms to kBtu



The measure case annual gas UEC is based on the ratio of efficiencies between the baseline efficiency and the measure case efficiency and is calculated as follows.

$$UEC_{measure} = UEC_{base} \times \left[\frac{CE_{base}}{CE_{measure}} \right]$$

CE_{base} = Base case boiler combustion efficiency

CE_{measure} = Measure case boiler combustion efficiency

The input parameters developed for the gas UES calculation are specified below, followed by explanations of the methods and sources of each value.

Gas Energy Savings Input Parameters

Parameter	Base Case Boiler	Measure Case Boiler	Source
Capacity Factor – Process Average (MBH out/MBH rated)	varies	41.9%	See “Average Boiler Capacity Factor, by Industry” table below.
Operating Hours per Year	8,760	8,760	Assumption of continual plant operation.
Tier 1 Process Water Boiler Combustion Efficiency (CE) (%)	82%	85.6%	Base Case: California Energy Commission (CEC). 2012. <i>2013 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24)</i> . CEC-400-2012-004-CMF-REV2.
Tier 2 Process Water Boiler Combustion Efficiency (CE) (%)	82%	93.9%	Measure Case: Data extracted on March 7, 2012 from the California Energy Commission (CEC). "Modernized Appliance Efficiency Database System (MAEDBS)." https://cacertappliances.energy.ca.gov/Login.aspx .
Process Steam Boiler Combustion Efficiency (CE) (%)	80%	84.4%	Base Case: California Energy Commission (CEC). 2012. <i>2013 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24)</i> . CEC-400-2012-004-CMF-REV2. U.S. Department of Energy (DOE), Energy Efficiency & Renewable Energy, Advanced Manufacturing Office. 2012. "Energy Tips: STEAM." DOE/GO-102012-3405. Measure Case: Data extracted on February 22, 2016 from the California Energy Commission (CEC). "Modernized Appliance Efficiency Database System (MAEDBS)." https://cacertappliances.energy.ca.gov/Login.aspx .
Conversion factor (therms/kbtu)	0.01	0.01	Conversion factor

Average Capacity Factor. Boilers, like many gas systems, have modulating controls to operate at a fraction of their nominal capacity. As a result, the number of operating hours of a boiler is not an accurate representation of its energy consumption, and the average capacity factor needs to be taken into account. As shown below, the capacity factor is the ratio of actual gas energy consumption during a certain time period and the maximum gas energy consumption that would have occurred if the boiler were to operate at full capacity during the same period.



$$\text{Capacity Factor} = \frac{\text{Actual Gas Energy Consumption}_t}{\text{Max. Gas Energy Consumption}_t}$$

Data for calculating average weighted capacity factor is provided in the following table. The average weighted capacity factor of industrial process boilers in California was derived from the analysis of industrial and commercial boilers conducted by Energy and Environmental Analysis, Inc. for the Oak Ridge National Laboratory (ORNL) in 2005; the analysis utilized the gross domestic product (GDP) of each industry in California and the total U.S. sourced from the Bureau of Economic Analysis. The number of boilers in California by industry is estimated by multiplying the total number of boilers in the U.S. by the California GDP as a percent of the total U.S. GDP. A weighting factor represents the percent of estimated number of boilers in California in each industry as a percent of the total estimated number of boilers in CA.

Average Boiler Capacity Factor, by Industry

Industry	Capacity Factor (%) ⁵	Number of Boilers (Total U.S.) ⁶	CA Industry GDP as % of Total U.S. Industry GDP (2006) ⁷	Estimated # of Boilers in CA	Weighting Factor (%)
Food	31%	10,610	9.7%	1,030	25.7%
Paper	66%	3,460	4.3%	149	3.7%
Chemicals	50%	11,980	8.8%	1,055	26.2%
Refining	25%	1,200	21.5%	258	6.5%
Metals	47%	3,330	4.5%	150	3.7%
Other	44%	12,435	11.1%	1,374	34.2%
Total		43,015		4,016	100.0%
Average Capacity Factor	43.8%				
Weighted Average Capacity Factor	41.9%				

Hours of Operation. The assumed hours of operation are based on continual plant operation. Variation in plant operating hours is accounted for in the capacity factor. While the boiler may operate during the entire year, it may not be operating at its full rated load.

⁵ Energy and Environmental Analysis, Inc. 2005. *Characterization of the US Industrial/Commercial Boiler Population*. Conducted for the Oak Ridge National Laboratory. Chapter 2.

⁶ Energy and Environmental Analysis, Inc. 2005. *Characterization of the US Industrial/Commercial Boiler Population*. Conducted for the Oak Ridge National Laboratory. Table 2-1, page 2-1.

⁷ U.S. Department of Commerce, Bureau of Economic Analysis. 2008. "Regional Economic Accounts: Gross Domestic Products by State." <http://www.bea.gov/regional/gsp/>. Accessed on January 8, 2008.

Base Case Average Boiler Efficiency. CE was used to determine the minimum measure case specification. Title 24 requires large water boilers to have a minimum combustion efficiency of 82% and large steam boilers to have a minimum thermal efficiency of 79%. While Title 24 is targeted specifically to space conditioning equipment, the more stringent code regulations are utilized for this measure analysis. In addition, because Title 24 evaluates steam boilers in TE, the CE of a water boiler was adjusted to estimate the CE of a steam boiler. In particular, the CE for a steam boiler was adjusted based upon the U.S. Department of Energy (DOE) Steam Tip Sheet #4.⁸ The CE of a steam boiler is assumed to be 2% less efficient than a comparable water boiler, assuming a 3% excess oxygen level and flue gas temperatures of ≥ 100 °F higher than a similarly sized water boiler. Therefore, the Title 24 minimum CE of a large water boiler was adjusted by 2% to derive the minimum CE for a large steam boiler.

Combustion Efficiency of Base Case Boilers

Boiler Type	Base Case Combustion Efficiency (CE)	Source
Water Process Boiler	82.0%	California Energy Commission (CEC). 2012. <i>2013 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24)</i> . CEC-400-2012-004-CMF-REV2
Steam Process Boiler	80.0%	U.S. Department of Energy (DOE). Energy Efficiency & Renewable Energy, Advanced Manufacturing Office. 2012. "Energy Tips: STEAM." DOE/GO102012-3405.

Measure Case Average Boiler Efficiency. Process boiler measure case efficiency ratings were calculated as the average TE of boilers registered in the California Energy Commission (CEC) Modernized Appliance Efficiency Database System. (Thermal efficiencies, not combustion efficiencies, were used to be consistent with the measure requirements.) The CEC database included over 3,000 gas boilers for steam and hot water production. To determine measure case efficiency ratings, boilers in the database were sorted in order of increasing TE and divided into steam and hot water boilers. The measure case efficiency ratings for each boiler type were calculated as the average ratings for Tier 1 and Tier 2 water and steam boilers with CE of at least 85%, 90%, and 83%, respectively. The calculated average CE ratings are shown below. The average CE of the Tier 1 and Tier 2 were calculated as the average of boilers below 2 MMBH and 2MMBH to 10 MMBH.

⁸ U.S. Department of Energy (DOE), Energy Efficiency & Renewable Energy, Advanced Manufacturing Office. 2012. "Energy Tips: STEAM." DOE/GO-102012-3405.



Average Combustion Efficiency of Measure Case Boilers

Boiler Type	Average Combustion Efficiency (CE)	Source
Tier 1 Water Process Boiler	85.6%	Data extracted on March 7, 2012 from the California Energy Commission (CEC). "Modernized Appliance Efficiency Database System (MAEDBS)." https://cacertappliances.energy.ca.gov/Login.aspx .
Tier 2 Water Process Boiler	93.9%	
Steam Process Boiler	84.4%	Data extracted on February 22, 2016 from the California Energy Commission (CEC). "Modernized Appliance Efficiency Database System (MAEDBS)." https://cacertappliances.energy.ca.gov/Login.aspx .

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 process boilers is presented below. Note that RUL is only applicable for add-on equipment and accelerated replacement measures and is not applicable for this measure.

Effective Useful Life and Remaining Useful Life

Parameter	Value	Source
EUL (yrs) – Water Process Boiler	20.0	California Public Utilities Commission (CPUC). 2014. "DEER2014EUL-table-update_2014-02-05.xlsx."
EUL (yrs) – Steam Process Boiler	20.0	
RUL (yrs)	n/a	n/a

BASE CASE MATERIAL COST (\$/UNIT)

Because the customer must purchase a new boiler to continue operations for a *normal replacement* installation, so the base case cost is that of a base case (standard) boiler.

The base case equipment cost (excluding installation and start-up cost) is based upon cost survey of equipment vendors that sell hot water and steam space heating boilers in California.⁹ The equipment cost for water boilers was calculated as the average of the equipment cost per kBtu/hr of 45 models in the base case equipment category, and the cost of steam boilers was calculated as the average cost per kBtu/hr of 16 models.

⁹ Southern California Gas Company. 2014. "WPSCGNRPH120206A-Rev05 May 2014 Process Boiler Costs.xlsx."

MEASURE CASE MATERIAL COST (\$/UNIT)

The measure case equipment cost (excluding installation and start-up cost) is based upon cost survey of equipment vendors that sell hot water and steam space heating boilers in California.¹⁰ The measure cost was calculated as the arithmetic average of the equipment cost per kBtu/hr for Tier 1 water process boilers (9 models), Tier 2 water process boilers (16 models), and steam boilers (5 models).

BASE CASE LABOR COST (\$/UNIT)

Insofar as installation costs for the base case and the measure case units are assumed to be the same, installation labor costs are not specified for this measure.

MEASURE CASE LABOR COST (\$/UNIT)

Insofar as installation costs for the base case and the measure case units are assumed to be the same, installation labor costs are not specified for this measure.

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, agriculture, and industrial 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, agriculture, and industrial programs sector programs for more than two years and for which impact evaluation results are not available.

Net-to-Gross Ratios

Parameter	Value	Source
NTG – Commercial	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 – Agriculture	0.60	
NTG – Industrial	0.60	

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.

¹⁰ Southern California Gas Company. 2014. “WPSCGNRPH120206A-Rev05 May 2014 Process Boiler Costs.xlsx.”

Gross Savings Installation Adjustment Rates

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

This section provides a summary of DEER-based inputs and methods, and the rationale for inputs and methods that are not DEER-based. The DEER 2016 database does not contain measures equivalent to the measures specified herein. Therefore, custom calculations were developed to estimate energy savings. The DEER 2016 documentation specifies applicable information for net-to-gross, installation rate, and effective and remaining useful life.

DEER Difference Summary

DEER Item	Comment
Modified DEER methodology	No
Scaled DEER measure	No
DEER Base Case	No
DEER Measure Case	No
DEER Building Types	No
DEER Operating Hours	No
DEER eQUEST Prototypes	No
DEER Version	No
Reason for Deviation from DEER	This measure is not in DEER
DEER Measure IDs Used	No
NTG	Source: DEER 2014. NTG value of 0.60 associated with NTG ID = <i>ComDefault>2yrs, Ag-Default>2yrs, Ind-Default>2yrs</i>
GSIA	GSIA = 1.0 associated with GSIA ID = <i>Def-GSIA</i>
EUL/RUL	Source: DEER 2016. EUL of 20 years is associated with EUL IDs: <i>PrCHt-Blr</i> and <i>PrCHt-StmBlr</i>



REVISION HISTORY

Measure Characterization Revision History

Revision Number	Revision Complete Date	Primary Author, Title, Organization	Revision Summary and Rationale for Revision
01	03/13/2018	Jennifer Holmes, Cal TF Staff	The draft of the text fields for this statewide measure is based upon: PGECOPRO101 Revision 5 (April 1, 2017) WPSCGNRPH120206A Revision 5 (May 28, 2014) Consensus reached among Cal TF members
	02/27/2019	Jennifer Holmes, Cal TF Staff	Revisions for submission of version 01.
	01/29/2021	Tai Voong, PG&E	Workpaper measure adoption by PG&E, no changes to energy efficiency savings or cost. Updated Ex-ante Implementation data table. No other changes.