Water Heating
Cal TF Tier 1 Presentation

CALIFORNIA
TECHNICAL FORUM

AL LUTZ
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DECEMBER 2017

eTRM Subcommittee Schedule

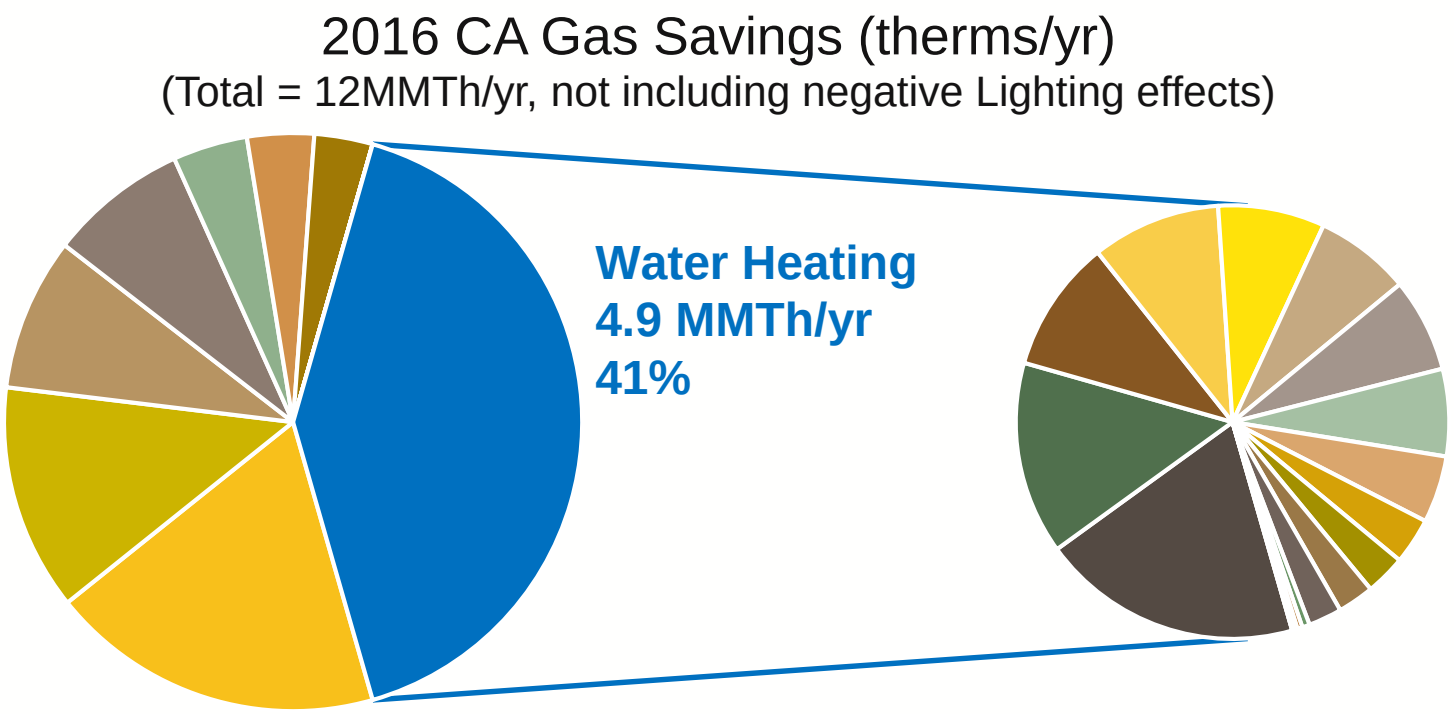
CALIFORNIA TECHNICAL FORUM

	4-Sep	11-Sep	18-Sep	25-Sep	2-Oct	9-Oct	16-Oct	23-Oct	30-Oct	6-Nov	13-Nov	20-Nov	27-Nov	4-Dec	11-Dec	18-Dec	25-Dec	1-Jan	8-Jan	15-Jan	22-Jan	29-Jan	5-Feb	12-Feb	19-Feb	2017	2018
Cal TF Meeting				9/28				10/26			11/16				12/14						1/25				2/21-2/22		
Governance / TPP															2a												
Commercial Refrigeration				1																	2					20	0
Food Service				1				2a			2															15	0
Agriculture / Pumps								1																	2	5	1
Lighting			T0	TC											1						2					11	42
HVAC															1										2	2	50
Water Heating															1										2	19	5
Appliance / Plug Load											1										2					10	12
Building Envelope																										0	4
Pools								1																	2	1	5
Process																										0	7
Miscellaneous								1																	2	2	4

Green numbers = Number of Measures; **Blue** numbers: **1**=First Review / **2** = Affirmation.

Water Heating Category Deemed Savings

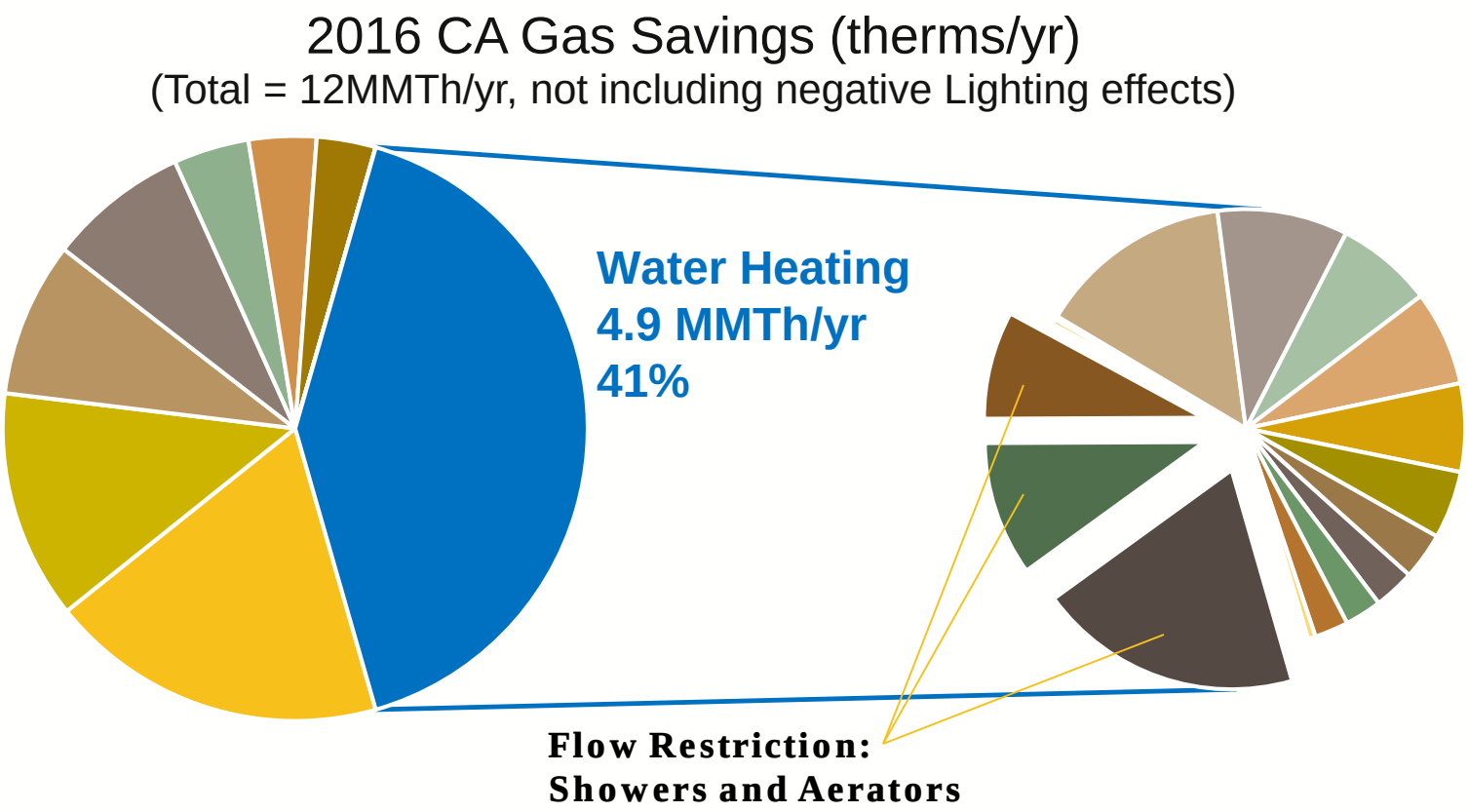
- Savings Perspective



Note: Water Heating has a large mix of Measures that contribute to the full savings.

Water Heating Category Deemed Savings

- Savings Perspective



Water Heating Measures - Original List

No.		Measure Names	Plan	PG&E	SCE	SDG&E	SCG	POU
6.01	Flow	Faucet Aerator and Low Flow Showerhead	2017					
6.02		Faucet Aerators for Bathroom/Kitchen Sinks in Residential Buildings	2017					
6.03		Low-Flow Showerheads	2017					
6.04		Temp-Initiated Shower Flow Restr. Valve w&w/o LF Showerhead	2018					
6.05		Laminar Flow Restrictor	2017					
6.06		Therm Savings Kit	2018					
6.07	Water Heaters	Boiler, Commercial	2017					
6.08		Tankless, Commercial	2017					
6.09		Storage Water Heater, Commercial	2017					
6.10		Boiler, Process	2017					
6.11		Direct Contact Water Heater, Process	2017					
6.12		Boiler, Multi-Family	2017					
6.13		Central Storage Water Heater, MF	2017					
6.14		Storage Water Heater, Residential	2017					
6.15		Tankless, Residential	2017					
6.16		Heat Pump Water Heater	2017					
6.17	Controls	Commercial Boiler Water Heating Control System	2018					
6.18		Demand Control for Centralized Water Heater Recirculation Pump	2017					
6.19		Multifamily DHW RCx, Training, and Boiler Reset Controller	2017					
6.20	Insul.	MF Central Recirc System Pipewrap	2018					
6.21		Hot Water Line Insulation Electric/Gas	2017					
6.22		Tank Insulation	n/a					
6.23	New	Faucet Aerators for Lavatory Sinks in Commercial Buildings	n/a					
6.24		Low-Flow Showerheads, Commercial	n/a					

Lead Workpaper
Supporting Workpaper
Workpaper Not Available

Water Heating Measures - Revised List

No.		Measure Names	Plan	PG&E	SCE	SDG&E	SCG	POU
6.01	Flow	Faucet Aerator and Low Flow Showerhead	2017	Consolidated				
6.02		Faucet Aerators for Bathroom/Kitchen Sinks in Residential Buildings	2017					
6.03		Low-Flow Showerheads	2017					
6.04		Temp-Initiated Shower Flow Restr. Valve w&w/o LF Showerhead	2017					
6.05		Laminar Flow Restrictor	2017					
6.06		Therm Savings Kit	2018	Consolidated				
6.07	Water Heaters	Boiler, Commercial	2017					
6.08		Tankless, Commercial	2017					
6.09		Storage Water Heater, Commercial	2017					
6.10		Boiler, Process	2017					
6.11		Direct Contact Water Heater, Process	2017					
6.12		Boiler, Multi-Family	2017					
6.13		Central Storage Water Heater, MF	2017					
6.14		Storage Water Heater, Residential	2017					
6.15		Tankless, Residential	2017					
6.16		Heat Pump Water Heater	2017					
6.17	Controls	Commercial Boiler Water Heating Control System	2018					
6.18		Demand Control for Centralized Water Heater Recirculation Pump	2017					
6.19		Multifamily DHW RCx, Training, and Boiler Reset Controller	2017	Combined with 6.17				
6.20	Insul.	MF Central Recirc System Pipewrap	2018	Hold - Sunset				
6.21		Hot Water Line Insulation Electric/Gas	2017					
6.22		Tank Insulation	2017					
6.23	New	Faucet Aerators for Lavatory Sinks in Commercial Buildings	2017					
6.24		Low-Flow Showerheads, Commercial	2018					
6.25		Recirculation Pump Time Clocks	New					

Removed 6.01 and 6.06 – Combined offerings

Combined 6.17 and 6.19
(6.17 has lodging AND MF)

Removed 6.20 - IOUs not offering

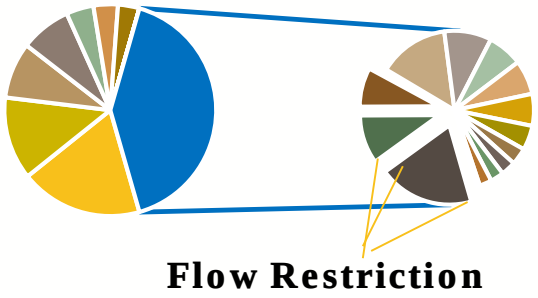
Blue text = Changed item

Lead Workpaper
Supporting Workpaper
Workpaper Not Available

Where Are We Today - Water Heating

- General Agreement on Measure Structure and Offerings

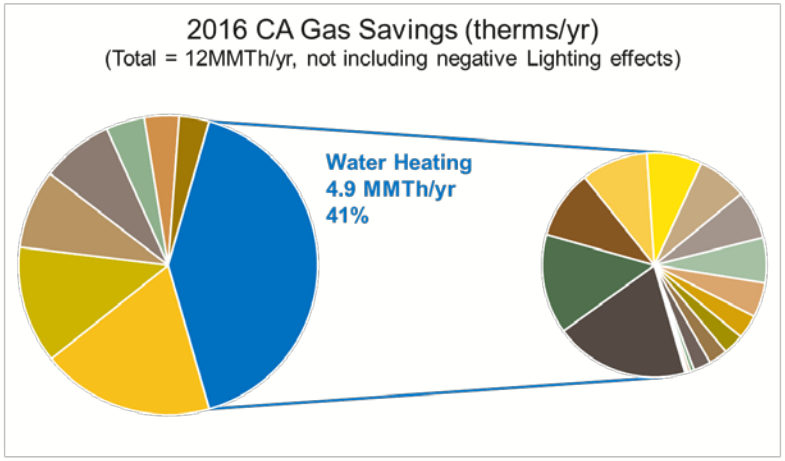
- Completed Measures (7)
  - Five Flow Reduction Measures, Tank Insulation, MF DHW Pump On/Off Control
- Near Completion (5)
  - Process Boilers
  - Direct Contact Water Heaters
  - MF DHW Boiler
  - MF Central Storage Water Heater
  - MF/Lodging DHW Loop Temperature Control



- Planned for 2017 (7)
  - Commercial Boilers
  - Water Heater Measures (4) – Res & Comm Storage and Instantaneous
  - Hot Water Heat Pumps – Heat Pump Water Heaters (1)
  - Pipe Insulation

Where Are We Going - Water Heating

- Add if Measures are Valuable for the eTRM – Be inclusive
- Additional Measures Expected in 2018
  - 6.24 Commercial Showerheads (SCG in progress)
  - 6.25 Timeclock Pump Control (SCG WP in progress)
  - 6.26 MF DHW Pump VFD Control (SCG prepared WP– passed through)
  - 6.27 Commercial DHW Pump VFD Control (SCG WP– with CPUC)
  - 6.28 Statewide WP for Tub Spout Diverters (not in TSVs – different methodology)



Green text indicates WP available

Measure Consensus
6.02 – Low Flow Aerators

- Offering
  - Kitchens - 1.5 and 1.8 gpm
  - Lavatories - 0.5, 1.0 and 1.2 gpm
  - Residential (SF and MF); Electric and Gas
  - Implementation: Retrofit Add On (REA/AOE), Direct Install (Typical)
- Stage 1 Issues
  - Used CPUC disposition input values in eTRM calculations - savings increase due to misapplication of number of aerators in therm kit and the recovery efficiency
  - Harmonize on base flow of 2.2 gpm
  - Harmonize on latest groundwater temperatures
  - Peak demand (kW) savings determination used in 2013 CPUC disposition (11% factor)
  - Agree on Costs (Actual costs based on DI program costs)
- Measure Extension
  - Added measure for POUs (electric measure)
  - Added measure for SCE and SDG&E (electric measure)
- Stage 2 Issues
  - *Add embedded energy in water based upon WEN Calculator (depending on other claims)*
  - *Data collection on pre-existing aerators and flows to determine retrofit type and baseline flow*
  - *Non-DI cost adjustment*

Black text = Current state of the consolidated measure
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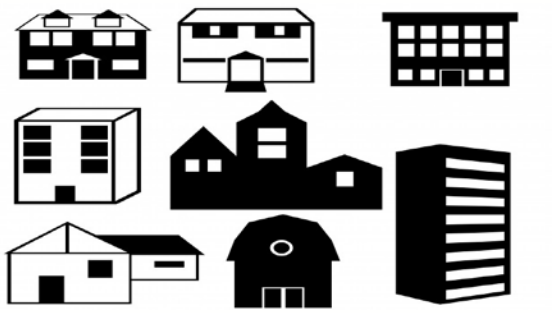
Measure Consensus
6.01 to 6.06 – Flow Measure DISPOSITION

- Disposition for Water Heating Flow Reduction Measures
  - February 22, 2013
  - Intent to Standardize Statewide Claims across IOUs
  - Used SCG / SDG&E Therm Saver Kit Measure with SCG / SDG&E Survey Data
  - Calculation Spreadsheet in Disposition
  - Biggest Change with Faucet Aerators
    - Adjusted for number of aerators in kit
    - Adjusted for lower recovery efficiency
    - Adjusted for lower gallons per day usage (also at showerheads)
    - Adjusted all measures for climate zones (groundwater or 'mains' temperature)

  - Summary
    - Disposition approach used
    - Climate Zone 'mains" temperatures updated for DEER updates (CPUC Guidance)
    - Savings changes in eTRM
    - Showerhead savings somewhat higher / aerator savings much higher

6.01 thru 6.06 – Flow Restriction Measures



- Overview
  - Separate SF and MF
  - MF in Residential
  - Climate Zone Differences (+/- 15%) – Included per CPUC Disposition
    - Based on dishwasher usage per 2013 CPUC disposition
    - 6.05 – LFR WP used CZ GW / MU water temperatures
    - Recommendation – use GW temperatures – revise as needed
    - Transparent, accurate, and consistent with other measures

Measure Consensus
6.02 – Low Flow Aerators

- Offering
  - Residential (SF and MF)
  - Electric and Gas
  - Kitchens - 1.5 and 1.8 gpm; Lavatories - 0.5, 1.0 and 1.2 gpm
  - Implementation: Retrofit Add On (REA/AOE), Direct Install (Typical)
- Stage 1 Issues
  - Used CPUC disposition input values in eTRM calculations - savings increase due to misapplication of number of aerators in therm kit and the recovery efficiency
  - Harmonize on base flow of 2.2 gpm
  - Harmonize on latest groundwater temperatures
  - Peak demand (kW) savings determination used in 2013 CPUC disposition (11% factor)
  - Agree on Costs *(Actual costs based on DI program costs).*
- Measure Extension
  - Added measure for POUs (electric measure)
  - Added measure for SCE and SDG&E (electric measure)
- Stage 2 Issues
  - *Add embedded energy in water based upon WEN Calculator (depending on other claims)*
  - *Data collection on pre-existing aerators and flows to determine retrofit type and baseline flow*
  - *Non-DI cost adjustment*

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Measure Consensus
6.03 – Low Flow Showerheads

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- Offering
  - Residential (SF and MF)
  - Electric and Gas
  - Bathroom Showerheads - 0.5, 1.0, 1.5, 1.6 and 1.7 gpm
  - Implementation: Replace on Burnout (ROB/NR) / NC/NEW or ER, Direct Install (Typical)
- Stage 1 Issues
  - Used CPUC disposition input values in eTRM calculations - savings increase due to misapplication of recovery efficiency
  - Add NC to all IOUs
  - Harmonize on latest groundwater temperatures
  - Agree on kW savings determination used in 2013 CPUC disposition (11% factor)
  - Agree on Costs - Base from DEER ($14.32), others from WO017 ($18.50 Measure Cost, $15.47 Labor Cost). *Or use DI program quotes for measure costs.*
- Measure Extension
  - Added measure for POUs (electric measure)
  - Added measure for SCE and SDG&E (electric measure)
- Stage 2 Issues
  - *Add embedded energy in water based upon WEN Calculator (depending on other claims)*
  - *Data collection on pre-existing showerhead flows to determine retrofit type and baseline flow*
  - *Update for required flow by CA Title 20 code (7/1/2018) for ROB/NC measures*
  - *Non-DI cost adjustment*

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Measure Consensus
6.04 Thermostatic Shut-off Valve (TSV)

- Offering
  - Residential (SF and MF)
  - Electric and Gas
  - TSV w/ and w/o Bathroom Showerheads - 0.5, 1.0, 1.5, 1.6 and 1.7 gpm
  - Implementation: TSV - REA/AOE, Direct Install (Typical)
    - Showerhead - Replace on Burnout (ROB/NR) / NC/NEW or ER,
    - Direct Install (Typical)
- Stage 1 Issues
  - Used CPUC disposition input values in eTRM calculations - savings increase due to misapplication of recovery efficiency
  - Add NC to all IOUs
  - Harmonize on latest groundwater temperatures
  - Behavioral factor used – lower time of wasted flow – 47 seconds based on published research
  - Agree on kW savings determination used in 2013 CPUC disposition (11% factor)
  - Agree on Costs – TSV costs from SCG. *Use updated DI program costs.*
- Measure Extension
  - Added measure for POUs
  - Added measure for SCE and SDG&E (electric measure)
- Stage 2 Issues
  - *Add embedded energy in water based upon WEN Calculator (depending on other claims)*
  - *Data collection on pre-existing showerhead flows to determine retrofit type and baseline flow*
  - *Update for required flow by CA Title 20 code (7/1/2018) for ROB/NC measures*
  - *Non-DI cost adjustment*

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Measure Consensus
6.05 – Laminar Flow Restrictors (LFRs)

- Offering
  - Healthcare
  - Gas only
  - Kitchens – 0.5, 1.0, 1.2, 1.5 and 1.8 gpm
  - Private Lavatories - 0.5, 1.0 and 1.2 gpm
  - Public Lavatories - 0.5 gpm (only)
  - Implementation: Retrofit Add-On (REA/AOE)
    - Direct Install (Typical) and PreRebDown

- Stage 1 Issues
  - Groundwater temps used in workpaper (updated DEER data)
  - Adjust mixed water temp of 106°F, efficiency at 77% for consistency with other flow measures
- Measure Extension
  - Added measure for POUs (gas measure)
  - Added measure for PG&E and SDG&E (gas measure)
- Stage 2 Issues
  - *Add embedded energy in water based upon WEN Calculator (depending on other claims)*
  - *Data collection on more types of facilities (nursing homes, medical office buildings, clinics) to determine base flows*
  - *Savings factor of 0.7 not supported (reduces baseline flow and savings from survey data)*

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Measure Consensus
6.23 – Commercial Aerators

- Offering
  - Kitchens - 1.5 gpm
  - Lavatories - 0.5, 1.0 and 1.2 gpm
  - Commercial (except HealthCare); Gas Only
  - Implementation: Retrofit Add-On (REA/AOE), Direct Install (Typical)
- Stage 1 Issues
  - Measured 1.67 gpm flow vs. 2.00 gpm flow for residential aerators
  - Measured mixed water temp of 97.9°F vs. 106°F for residential aerators
  - Agree on measure costs – use SCG WP costs from vendor and 3P installer ($2.89 Material Cost, $4.28 Labor Cost) – Base cost $0 (REA/AOE)
- Measure Extension
  - Added measure for POUs (gas measure)
  - Added measure for PG&E and SDG&E (gas measure)
- Stage 2 Issues
  - *Add embedded energy in water based upon WEN Calculator (depending on other claims)*
  - *Data collection on pre-existing aerators to determine baseline type*

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Measure Consensus
6.17/6.19 – MF DHW Loop Temp Control

- Offering
  - MF and Lodging Only
  - Gas Only
  - Existing Buildings with Gas Water Heating
  - Implementation: Retrofit Add-On (REA/AOE), PreRebDown
- Stage 1 Issues
  - No expected climate zone (CZ) variation
  - Use PG&E methodology
- Measure Extension
  - Added measure for POUs (gas measure)
- Stage 2 Issues
  - Modify savings from PG&E approach (based on RASS usage and simple equation with assumed reduced loop temperature)
    - SCG used eQUEST models (not available or reviewed)
    - Test case for transition from eQUEST to Open Studio
  - *Expand to other commercial building types – hospitals, offices, etc.*

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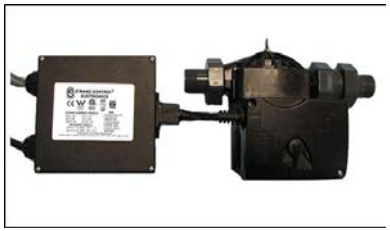
Measure Consensus
6.18 – MF DHW Pump Control (On/Off)



- Offering
  - MF Only
  - Electric and Gas
  - Existing Buildings
  - Implementation: Retrofit Add On (REA/AOE), Direct Install (DI) and PreRebDown
- Stage 1 Issues
  - Agree on Costs – Use SCG / PG&E / SCE WP costs from vendors and RS Means estimates
    - Small and Large Facility Size ($37.10 and $18.55/unit materials, $2.68 and $1.34/unit labor)
    - SDG&E had higher costs than the other WPs (older WP).
  - SDG&E WP savings calculations are by installation and not consistent with other WPs (which reference the CASE study)
- Measure Extension
  - Added measure for POUs
- Stage 2 Issues
  - *Consider more granular approach than only small and large (aka low rise and high rise) buildings - currently savings per unit based on facility sizes of 44 and 88 units*
  - *Extend to commercial – SCG VFD DHW Pump WP in progress*

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Measure Consensus
6.22 – Tank Insulation

- Offering
  - Commercial and Industrial
  - Gas Only
  - 1 inch or 2 inch insulation on Medium / High Temperature Tanks, Medium / Low Usage
  - Implementation: Retrofit Add-On (REA/AOE), PreRebDown
- Stage 1 Issues
  - Agree on Costs – Use PG&E / SCG WP costs from vendor and RS Means estimates
    - 1” and 2” thick ($7.31 or $9.19/unit materials, $2.18 or $2.85/unit labor)
    - SDG&E had lower costs – older WP
- Measure Extension
  - None
- Stage 2 Issues
  - None

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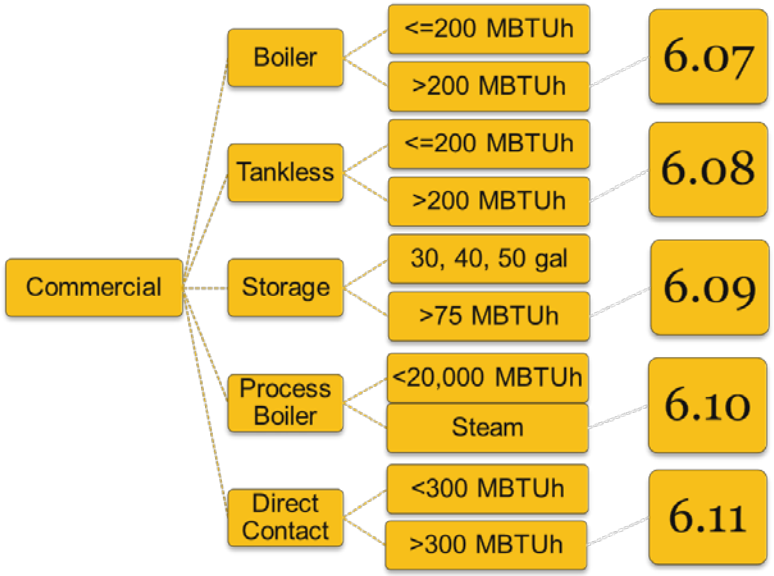
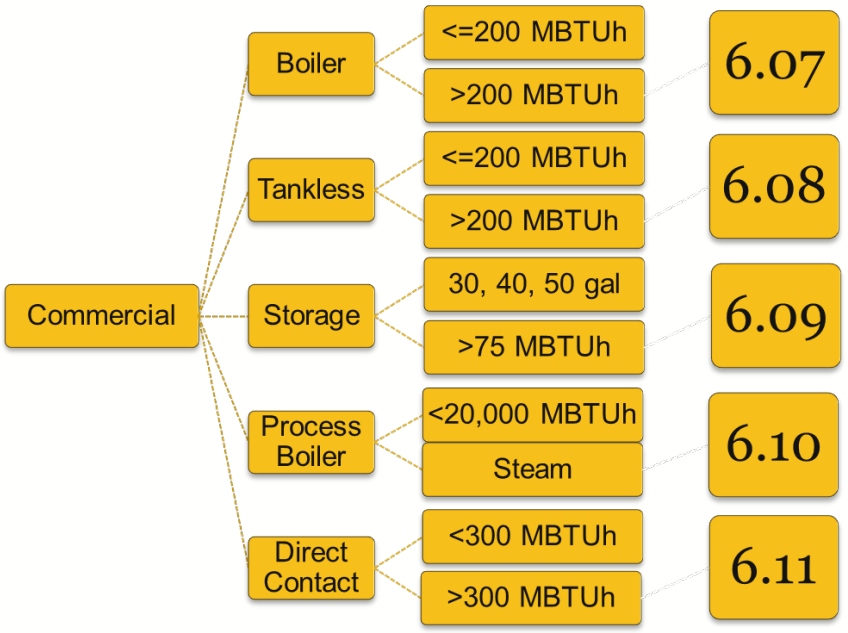
Several Water Heater & Boiler Offerings and Tiers - Commercial



- Commercial measures
- Current system has frequent mis-match in offerings and tiers (red)

No.	PG&E	SCG	SDG&E	SCE	Commercial	Capacity	Efficiency
6.07	x				Comm Boiler	Small (>75MBTU/h)	>90% TE
6.07		x	x			Small/Med (<=200MBTU/h)	>=84% EF
6.07		x	x				>=90% EF
6.07		x	x			Large (>200MBTU/h)	>=84% TE
6.07		x	x				>=90% TE
6.07	x						>=85% TE
6.07	x						>=90% TE
6.08		x			Comm Tankless	Small/Med (<=200MBTU/h)	>=82% EF
6.08			x				>=80% EF
6.08		x	x				>=90% EF
6.08		x	x			Large (>200MBTU/h)	>=80% TE
6.08		x	x				>=90% TE
6.09		x			Comm Storage	Small, 30g (<=75MBTU/h)	>=70% EF
6.09		x				40 gal	>=67% EF
6.09		x				50 gal	>=67% EF
6.09			x			Small, 30g (<=75MBTU/h)	>=67% EF
6.09			x			40 gal	>=65% EF
6.09			x			50 gal	>=64% EF
6.09			x			60 gal	>=62% EF
6.09			x			75 gal	>=59% EF
6.09		x	x			Large (>75MBTU/h)	>=83% TE
6.09	x	x	x				>=90% TE
6.10	x	x	x		Process Boiler	(<20,000MBTU/h)	>=85% CE / >=83% TE
6.10		x	x			(<20,000MBTU/h)	>=90% CE / >=88% TE
6.10	x	x	x			Steam	>83% CE
6.11	x		x		Direct Contact	<300MBTU/h	>= 88% AFUE
6.11	x		x			>300MBTU/h	>=90% TE

Harmonizing Commercial SW Heater & Boiler Offerings and Tiers

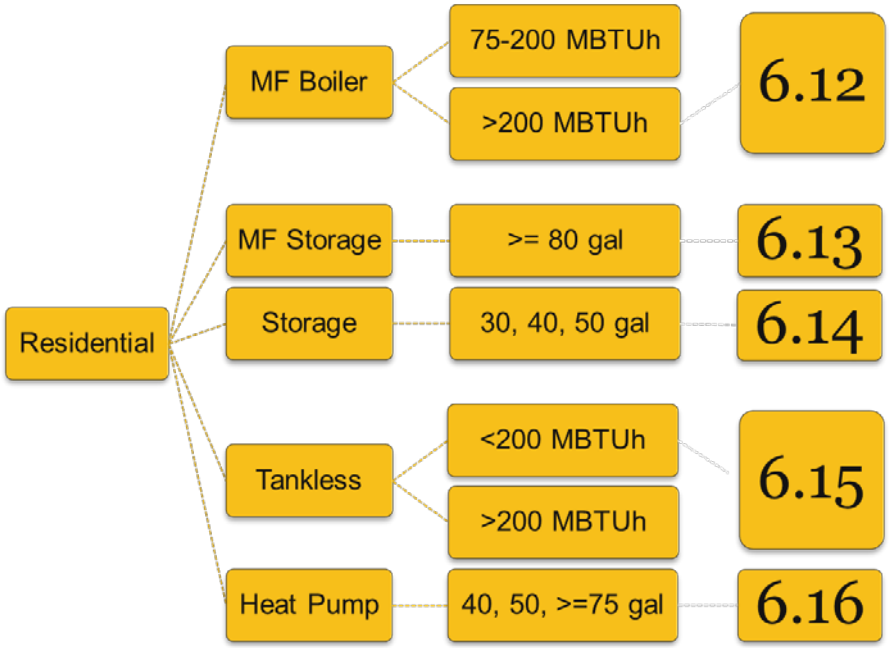


	Measure	Capacity	Efficiency
6.07	Comm Boilers	Small/Med (<=200MBH)	>=84% EF
			>=90% EF
		Large (>200MBTU/h)	>=84% TE
			>=90% TE
6.08	Comm Instantaneous	Small/Med (<=200MBH)	>=90% EF
		Large (>200MBTU/h)	>=84% TE
			>=90% TE
6.09	Comm Storage	Small, 30g (<=75MBH)	>=70% EF
		40 gal	>=67% EF
		50 gal	>=67% EF
		Large (>75MBTU/h)	>=83% TE
			>=90% TE
6.10	Process Boiler	(<20,000MBTU/h)	>=85% CE / >=83% TE
		(<20,000MBTU/h)	>=90% CE / >=88% TE
		Steam	>83% CE
6.11	Direct Contact Water Heaters	<300MBTU/h	>= 88% AFUE
		>300MBTU/h	>=90% TE

- Simplifying offerings and tiers
  - Lower tiers can be omitted from programs
- Match with residential where applicable
- For smaller commercial units, UEF values are being developed; planning to include in text.
- Savings recalculation and replacement of EF values may occur in Stage 2.

- Impact: Harmonized approach; Continued alignment with changing measures.

Several Residential Water Heater & Boiler Offerings and Tiers

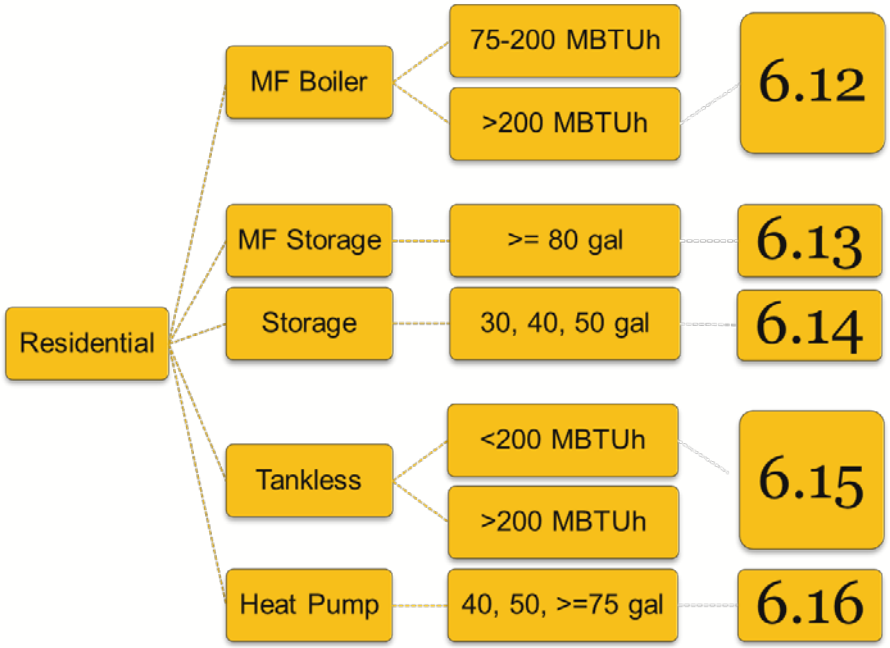


- Residential example
- Current system has frequent mis-match in offerings and tiers (red)

Existing Structure

	PG&E	SCG	SDG&E	SCE	Residential	Capacity	Efficiency
6.12	x				MF Boiler	Small (>75MBTU/h)	>=84% TE
	x					Small (75-200MBTU/h)	>=90% TE
		x				Large (>200MBTU/h)	>=84% TE
	x	x					>=90% TE
6.13		x			MF Storage	>80 Gal (>75MBTU/h)	>=83% TE
		x					>=90% TE
	x						>=82% TE
6.14			x		Res Storage	30 Gal	EF (0.65-0.69)
			x			40 Gal	EF (0.65-0.66)
			x			40 Gal	EF (0.67-0.69)
			x			40 Gal	EF (0.70+)
			x			50 Gal	EF (0.67-0.69)
			x			50 Gal	EF (0.70+)
		x				30, 40, 50 Gal	>=62% EF
		x				30, 40, 50 Gal	>=67% EF
	x					Small (<75MBTU/h)	>=.67 EF
6.15	x				Res Tankless	Small (<200MBTU/h)	>=85% EF
		x					>=90% EF
		x				Small (76-200MBTU/h)	>=82% EF
		x					>=92% EF
	x						>=90% TE
						Large (>200MBTU/h)	>=84% TE
	x						>=90% TE
6.16			x		Heat Pump	40 gal (min.)	EF=2.0, BL-1
			x			50 gal	EF=2.0, BL-1
			x			60 gal	EF=2.0, BL-1
			x			75 gal (and up)	EF=2.0, BL-1
	x					40 gal (min.)	EF=2.0, BL-2
	x					50 gal	EF=2.0, BL-2
	x					60 gal	EF=2.0, BL-2
	x					75 gal (and up)	EF=2.0, BL-2
	x		x	x		40 gal (min.)	EF=2.0, BL-3

Harmonizing Residential Water Heater & Boiler Offerings / Tiers

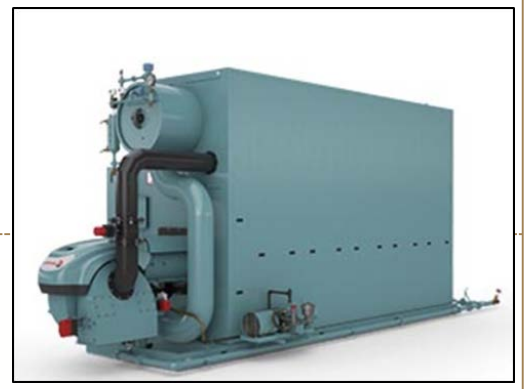


	Residential Technology	Capacity	Qualifying Efficiency
6.12	MF Boiler	Small (75-200MBTU/h)	>=84% TE
			>=90% TE
		Large (>200MBTU/h)	>=84% TE
			>=90% TE
6.13	MF Storage	>=80 Gal (>=75MBTU/h)	>=82% TE
			>=90% TE
6.14	Res Storage	30 Gal (<75 MBTU/h)	>=70% EF
		40 Gal	>=67% EF
		50 Gal	>=67% EF
6.15	Res Tankless	Small (<=200MBTU/h)	>=84% EF
			>=90% EF
		Large (>200MBTU/h)	>=84% TE
			>=90% TE
6.16	Heat Pump	40 gal	>= 2.0 EF
		50 gal	>= 2.0 EF
		>=75 gal	>= 2.0 EF

- Simplifying offerings and tiers
  - Lower tiers can be omitted from programs
- Match with commercial where applicable
- For residential units, UEF values are being developed; planning to include in text.
- Savings recalculation and replacement of EF values may occur in Stage 2.

- Impact: Harmonized approach; Continued alignment with changing measures.

Measure Consensus
6.10 – Process Boilers



- Offering
  - Industrial (All – Not Selected NAICS Codes)
  - Gas Only
  - Implementation: Replace on Burnout (ROB/NR), Midstream / PreRebDown
- Stage 1 Issues
  - Agree on capacity factor (PG&E value of 41.9% based on published source)
  - Agree on baseline hot water boiler efficiency
    - HW boiler baseline CE (82% PG&E – 80% SCG)
    - Does Title 20 / Title 24 code allow exemptions to process boilers – definition of boiler?
  - Collapse on average measure efficiency across HW boiler sizes (from SCG WP)

Measure Calculation	Hot Water Tier 1	Hot Water Tier 2	Steam Tier 1
Combustion Efficiency	85.6%	93.9%	84.4%

- Measure Extension
  - Added Measure to POUs
- Stage 2 Issues
  - *Separate steam baseline efficiencies for natural gas draft type (natural or not)*
  - *Convert to thermal efficiencies to align with other boilers*
  - *More current sources (like CASE study) for capacity factor for CA industry*
  - *Revisit and include CZ variation*

Black text = Current state of the consolidated measure
Blue text = Changing and / or first time item is mentioned
Italics text = Item that has not been completed

Measure Consensus
6.11 – Direct Contact Water Heater

- Offering
  - Industrial (No Select NAICS Codes)
  - Gas only
  - Implementation: Replace on Burnout (ROB/NR), Midstream
- Stage 1 Issues
  - Use PG&E capacity factor (PG&E value of 41.9% based on published source) for consistency
- Measure Extension
  - Added Measure to POUs
  - *Added Measure to SDG&E / SCG (new savings also – was incorporated as Tier 2 process boilers previously)*
- Stage 2 Issues
  - *Convert to thermal efficiencies to align with other boilers*
  - *More current sources (like CASE study) for capacity factor for CA industry*
  - *Revisit and include CZ variation (default for SCG/SDG&E included)*

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Measure Consensus
6.12 – MF Boilers

- Offering
  - Multifamily only
  - Gas only
  - Implementation: Replace on Burnout (ROB/NR), PreRebDown preferred
    - Midstream / Upstream possible
- Stage 1 Issues
  - None
- Measure Extension
  - Added measure for POUs
  - Added measure for PG&E / SDG&E
- Stage 2 Issues
  - *Consider including Climate Zone variation*

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Measure Consensus
6.13 – Central Storage Water Heaters

- Offering
  - Multifamily only
  - Gas only
  - Implementation: Replace on Burnout (ROB), PreRebDown preferred
    - Midstream / Upstream Direct Install Possible
- Stage 1 Issues
  - Adopt two efficiency tiers consistent with SCG WP
    - Non-condensing
    - Condensing
- Measure Extension
  - Added measure for POUs
  - Added measure for SDG&E
- Stage 2 Issues
  - *Consider including climate zone variation*

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Measure Consensus
6.07 – Commercial Boilers

- Offering
  - Commercial (Multifamily/PG&E)
  - Gas Only
  - Implementation: Replace on Burnout (ROB), PreRebDown preferred
    - Midstream / Upstream possible
- Stage 1 Issues
  - Adopt two efficiency tiers consistent with SCG WP
    - Non-condensing
    - Condensing
- Measure Extension
  - Added measure for POUs
  - Added measure for SDG&E
- Stage 2 Issues
  - None

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Measure Consensus
6.16 – Heat Pump Water Heaters

- Offering
  - Residential
    - (Commercial applications referenced in PG&E Workpaper text only)
  - Electric Only
  - 50 gal Heat Pump water heater replacing 30/40/50 gallon electric storage heater
  - Implementation: Replace on Burnout (ROB/NC), PreRebDown/ Up
    - Direct Install possible
- Stage 1 Issues
  - Adopt SCE approach – new WP approved
  - *Measure efficiency of 3.24 EF (CPUC)*
  - *Convert EF to UEF in text*
- Measure Extension
  - Added measure for POUs
- Stage 2 Issues
  - *Consider Early Retirement / Accelerated Replacement*
  - *Consider fuel switching from gas*
  - *Convert savings from EF to UEF in calculator (v2.1)*

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Measure Consensus
6.14 – Residential Storage Water Heaters

- Offering
  - Residential
  - Electric and Gas
  - Implementation: Replace on Burnout (ROB/NC), PreRebDown
- Stage 1 Issues
  - Use DEER approved calculator and approach
  - Most Current: WaterHeater-Calculator v2.1.xlsm – older version in WPs
  - *Convert EF to UEF values in text*
- Measure Extension
  - Added measure for POUs (electric measure)
- Stage 2 Issues
  - *Add savings based on UEF values – calculator conversion in progress*

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Measure Consensus
6.09 – Comm Storage Water Heaters

- Offering
  - Commercial Electric and Gas
  - Implementation: Replace on Burnout (ROB/NC)
  - PreRebDown / Up / Mid
    - Direct Install possible (MF)
- Stage 1 Issues
  - Use DEER approved calculator and approach
  - Most Current: WaterHeater-Calculator v2.1.xlsm – older version in WPs
  - *Convert EF to UEF values in text*
  - Industrial and commercial - larger heaters, calculations use TE
- Measure Extension
  - Added measure for POUs (electric measure)
- Stage 2 Issues
  - *Add savings based on UEF values – calculator conversion in progress*

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Measure Consensus
6.14 – Res Instantaneous Water Heaters

- Offering
  - Residential
  - Electric and Gas
  - Implementation: Replace on Burnout (ROB/NC), PreRebDown / Up
- Stage 1 Issues
  - Use DEER approved calculator and approach
    - Most Current: WaterHeater-Calculator v2.1.xlsm –
      - Older version in current WPs
  - *Convert EF to UEF values in text*
- Measure Extension
  - Added measure for POUs (electric measure)
- Stage 2 Issues
  - *Add savings based on UEF values – calculator conversion in progress*

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Measure Consensus
6.08 – Comm Instantaneous Water Heaters

- Offering
  - Commercial Electric and Gas
  - Implementation: Replace on Burnout (ROB/NC), PreRebDown
    - PreRebUp and DI (MF) Possible
- Stage 1 Issues
  - Use DEER approved calculator and approach
    - Most Current: WaterHeater-Calculator v2.1.xlsm – older version in WPs
  - *Convert EF to UEF values in text*
  - *Industrial and commercial - larger boilers, calculations use TE*
- Measure Extension
  - Added measure for POUs (electric measure)
- Stage 2 Issues
  - *Add savings based on UEF values – calculator conversion in progress*

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Measure Consensus
6.21 – Pipe Insulation

- Offering
  - Commercial and Industrial
  - 1 inch insulation on uninsulated HW / steam lines
  - Gas Only
  - Implementation: Retrofit Add-On (REA/AOE), PreRebDown
    - BRO?
- Stage 1 Issues
  - Use SCG developed calculator
    - Standalone tool based on 2014 / 2015 Itron ESPI Pipe Insulation Reports
      - Expands for multiple iterations allows accurate estimation for outdoor piping
- Measure Extension
  - None
- Stage 2 Issues
  - Consider damaged insulation (SDG&E WP)

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6.01 thru 6.25 – Hot Water Measures

- Cross Cutting Issues
  - Be inclusive - include multiple offerings (efficiency tiers)
    - Expand commercial to agricultural and industrial where relevant
    - Expand NR/ROB measures to include NEW/NC where possible
    - Consider AR/ER baseline types for several measures (Instantaneous heaters, damaged insulation, HPWHs, etc.) in light of R4818 / AB802

6.01 thru 6.22 – Hot Water Measures
Other New Measures – Stage 2

- Combination Space/Water Heating Boilers
- CO2 HPWHs
- Other Technologies
  - Table top water heaters
  - Grid enabled water heaters (demand response)
  - Desuperheaters
  - Gas/electric fuel switching measures
    - HPWHs
    - Others?
    - 3 prong test and all GHG impacts (leaks, fuel mix, etc.)
- Recommendation – Stage 2 (2018)

Water Heating

NEXT WH SUBCOMMITTEE MEETING DATE
Dec. 20, 2017 @ 1 PM

Ad Hoc by email as needed?

Questions?

Next Steps?

SHW / DHW Measures
Representative Measure Savings Claims

CALIFORNIA TECHNICAL FORUM

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No.	Name	Sum of NumUnits	Energy (kWh/yr)	Demand (kW)	Energy (therms/yr)
6.01	Faucet Aerator and Low Flow Showerhead	18,822	42,306	4.25	18,852
6.02	Faucet Aerators for Bathroom/Kitchen Sinks in Residential Buildings	232,384	30	0.00	397,107
6.03	Low-Flow Showerheads	83,141	0	0.00	493,980
6.04	Temp-Initiated Shower Flow Restr. Valve w&w/o LF Showerhead	8,637	0	0.00	13,461
6.06	Therm Savings Kit	139,674	0	0.00	971,101
6.07	Boiler, Commercial	394,267	33,809	0.94	717,657
6.08	Tankless, Commercial	32,928	(16,629)	0.03	135,539
6.09	Storage Water Heater, Commercial	205,301	0	0.00	324,740
6.10	Boiler, Process	419,761	0	0.00	484,035
6.12	Boiler, Multi-Family	18,395	0	0.00	28,089
6.13	Central Storage Water Heater, MF	5,798	0	0.00	6,389
6.14	Storage Water Heater, Residential	14,980	18,354	1.79	305,457
6.15	Tankless, Residential	109,485	38,451	12.51	449,694
6.16	Heat Pump Water Heater	506	842,354	181.61	0
6.18	Demand Control for Centralized Water Heater Recirculation Pump	16,089	440,908	48.97	349,389
6.21	Hot Water Line Insulation Electric/Gas	64,080	0	0.00	1,024,128
6.22	Tank Insulation	18,707	0	0.00	186,005
Grand Total		**1,782,954**	**1,399,584**	**250.10**	**5,905,622**

Representative as claims track to IOU WPs – not all proposed eTRM numbers included. May also have had zero claims in 2016.