


Water Heating Subcommittee Consolidation and Offerings



**AL LUTZ
AYAD AL-SHAIKH
DECEMBER 7, 2017
MEETING # 4**

Subcommittee Timeline

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	29-May	5-Jun	12-Jun	19-Jun	26-Jun	3-Jul	10-Jul	17-Jul	24-Jul	31-Jul	7-Aug	14-Aug	21-Aug	28-Aug	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	2017	2018	
Cal TF Meeting				6/22					7/27									9/28				10/26			11/15-16				12/14							1/25		
Governance / TPP																																						
Commercial Refrigeration																		1							2										tbd	20	0	
Food Service																		1				2													tbd	15	0	
Agriculture / Pumps											TO TC											1			2										tbd	5	1	
Lighting																	TO TC								1				2						tbd	11	42	
HVAC																									1				2						tbd	2	50	
Water Heating														TO TC											1										2	22	0	
Appliance or Plug Load														TO TC											1				2						tbd	10	12	
Building Envelope																																				0	4	
Pools																						1													2	1	5	
Process																																				0	7	
Miscellaneous																						1			2										tbd	2	4	
Low Income Measures																																						

May change number of measures in 2017 (attrition) & 2018 (delayed and new)

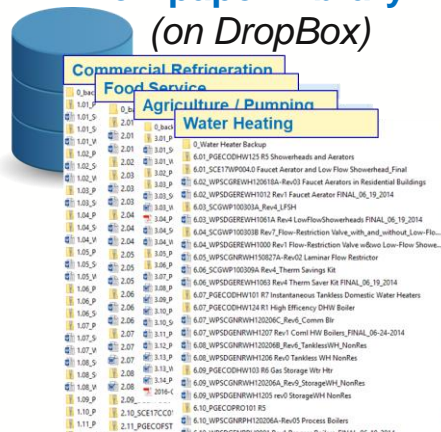
Green numbers = Number of Measures; **Blue** numbers: **1**=First Review / **2** = Affirmation.

Subcommittee Process

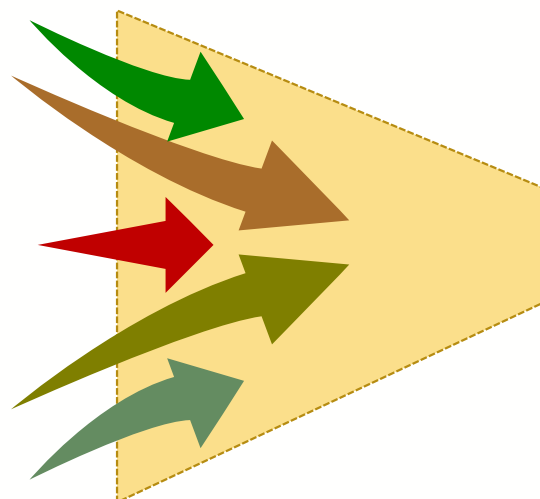
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1. Workpaper Library

(on DropBox)



Subcommittee Process



Consolidated Text Files



Consolidated Data Files



2. EE Stats: 2016 Portfolio Savings

- PA, Program
- End-Use, Sub-End-Use
- Climate Zone, Zip Code

3. CEDARS: 2016 Deemed Savings

- Workpaper
- Offering



4. Ex Ante Measure Tables:

- Impact -> Permutations
- Measure
- Implementation
- Measure Cost

5. New Data



Cal TF Members
IOU Representatives
CPUC Representatives
POU Representatives
Industry Experts

Where Are We Today - Water Heating

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- General Agreement on Measure Structure and Offerings
- Add if Measures are valuable for the eTRM
 - Be inclusive, with new measures
- **Smaller Measures being completed – Not moved to 2018**
 - ✦ HW Thermostatic Shower Valves (TSVs)
 - ✦ Tank Insulation
 - ✦ New Measure - Commercial Aerators (ED passed through)
 - ✦ MF DHW Pump On/Off Control
- **Additions of Measures – 2018**
 - ✦ Commercial Showerheads (SCG in progress)
 - ✦ Timeclock Pump Control (SCG WP in progress)
 - ✦ **MF DHW Pump VFD Control (SCG prepared – passes through)**
 - ✦ Commercial DHW Pump VFD Control (SCG – with CPUC)
 - ✦ **Statewide WP for Tub Spout Diverters (not in TSVs – different methodology)**

Agenda and Goals – Water Heating

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- Final Goal – about 22 eTRM measures by January!
- Goals for Today
 - Consensus on Costs for Aerators / Showerheads / LFDs
 - ✦ DI implementer quotes to be used
 - Control Measure Combined / Insulation Measure not Used
 - Two more completed measures / text drafting for two others
 - ✦ *See next slide*
 - 15 more measures to go
 - Describe UEF conversion process
 - Review areas needed for consensus for each measure

Past Monthly Goal – Water Heating

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- Data Specs Completed in November 2017
 - ✦ Commercial Faucet Aerators (SF/MF) – SCG only
 - ✦ Tank Insulation (NAIMA tool used) – IOUs agree
 - ✦ TSV w/wo LF Showerheads (SF/MF – SCG – PG&E)
 - Checking PG&E variation
 - ✦ MF DHW Pump Controller (on/off) – CASE studies used
 - SDG&E older WP - not used for savings accuracy and consistency purposes
 - SCG expanding for VFD control / Commercial applications
 - Future work in 2018

All have CZ variations

Define SWH / DHW Measures

Original Measure List



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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 Bathroom/Kitchen Sinks, Commercial	n/a					
6.24		Low-Flow Showerheads, Commercial	n/a					
6.25		Recirculation Pump Time Clocks	2017					

*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*

 Lead Workpaper
 Supporting Workpaper

Costs – 6.02 Low Flow Aerators

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- Original e TRM proposal – SCE Total Measure cost = \$15.01
 - Measure cost \$7.73 – three cost quotes from 2016 online retailer (SCE).
 - Labor cost \$7.28 -DEER 2008 assumptions of 7.2 mins (0.12 hr) with 2016 RSMeans (\$64.40) average national plumber labor rate (\$64.40/hr)
- PG&E -\$10.44 for base costs, \$13.24 for measure costs (including labor).
- SDG&E - measure cost of \$13.24 from DEER
 - \$6.54 for materials and \$6.70 for labor
- SCG WP measure costs - 2013 program cycle negotiated 3rd party contractor installation costs for direct install programs.
 - The gross measure cost is \$7.99 for Kitchen Aerators and \$5.43 for Bathroom Aerators (including labor).
 - Maybe most appropriate for predominant delivery mechanism – **need more source detail.**
 - May be updated – are the same costs being used today?

Costs – 6.03 Showerheads

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- Original e TRM proposal – Combination of WO017 (MCS or Measure Cost Study) and DEER costs
- PG&E -**\$14.32** for base, **\$31.06** for measure costs (including **\$16.74** for labor). From DEER 2014 (last revised in DEER 2008 updates).
 - Measure **\$29.22** for materials and **\$16.74** for labor
- SCG/SDG&E - measure cost from DEER 2008
 - Base **\$14.32** for materials and **\$16.74** for labor
 - Measure **\$29.22** for materials and **\$16.74** for labor
- SCE - measure cost from WO017 Measure Cost Study
 - Base **\$0** for materials and **\$0** for labor
 - Measure **\$18.50** for materials and **\$15.47** for labor
- Recommendation – Need base costs and measure costs
 - Use updated SCE measure costs
 - Use non-zero base costs for ROB/NEW baseline types

6.04 Temp-Initiated Shower Flow Restriction Valve (TSV) with and without LF Showerhead

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- Delivery Mechanism - Direct Install (all IOUs)
 - PG&E SCG allow Pre Rebate Down
 - SCG / SDG&E DI MF, UpReb SF downstream rebate
 - Recommendation – all delivery types – GSIA and NTGR change
- SCG uses Tub Spout Bypass Factor of 80% in GSIA – need to apply in savings calc
- Breakout LF Showerheads from TSV – TSV with existing or LF showerhead (installed together)
 - Required grouping together to avoid double counting (less time with LF showerhead)
- Costs
 - PG&E Base \$14.32 materials, \$16.74 labor; Measure \$39.95 for materials and \$16.74 for labor
 - SCG Base \$22.95 materials, \$15.00; Measure \$39.95 for materials (\$29.95 valve only) and \$15.00 for labor (valve or valve and showerhead)
 - SDG&E Base \$14.32 materials, \$16.74; Measure \$39.95 for materials and \$16.74 for labor

6.01 thru 6.06 – Flow Restriction Offerings –

6.04 TSV w/wo LF Showerhead Summary



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LF Showerheads	PG&E	SCE	SDG&E	SCG	Recommended Value
Base Flow	2.5 or greater		2.25	2.25 ROB/New 2.25/1.8 RET	2.25 ROB/2.0 New 2.25/1.8 RET
Measure EE gpm	1.6		1.5. / 1.6 / 1.7	1.0/1.25/1.5/1.6/1.7	1.0/1.25/1.5/1.6/ 1.7
Notes	CPUC disposition for savings - Combined WP			Valve only and Valve+ Swhd – No Tankless Applications	
Electric Savings	X				X
Gas Savings	X		X	X	X
Baseline Type	ROB		RET/ROB/NEW	REA – TSV only ROB/RET/New – TSV + Swhd	ER / New
EUL	10		10	10 / 3.33*	10 / 3.33*
RUL	na		--	0 / 6.67	0 / 6.67
SF / MF Different Savings	?		X	X (~10% difference)	X

Is ROB and NEW consistent with Direct Install (DI) Delivery Type ?

Measure Consensus

6.04 – TSV w/ and w/o LF Showerheads

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- Offering

- Residential (SF/MF), TSV alone or with 0.5, 1.0, 1.5, 1.6 and 1.7 gpm; Electric and Gas; Replace on Burnout (ROB/NR) / NC/NEW or ER; Direct Install (Typical), Other delivery

- Stage 1 Issues

- Add NC to all IOUs
- Behavioral factor used – lower time of wasted flow – 47 seconds based on published research
- Agree on climate zone factors
- Agree on all delivery channels
- Agree on kW savings determination used in 2013 CPUC disposition (11% factor)
- Agree on Costs – Use SCE costs for LF Shwds
- TSV costs - SCG Costs seem most relevant – not a big disconnect

- Measure Extension

- Add Electric offerings to all IOUs/POUs

- Stage 2 Issues

- Add embedded cost of energy in water by climate zone
- Data collection on pre-existing showerheads to determine baseline flow
- Update for required flow by CA T20 code (7/1/2018) for ROB/NC measures

Measure Consensus

6.23 – Commercial Aerators

- Offering

- ❑ Commercial (except healthcare), TSV alone or with 0.5 gpm public; 0.5, 1.0, 1.2 gpm private lavatories; 1.5 gpm Kitchens, Gas only; REA / AOE; Direct Install

- Stage 1 Issues

- ❑ 1.67 gpm measured 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 kW savings determination used in 2013 CPUC disposition (11% factor)
- ❑ 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

- ❑ Add Gas offerings to all IOUs/POUs – only SCG presently

- Stage 2 Issues

- ❑ *Add embedded cost of energy in water by climate zone*
- ❑ *Data collection on pre-existing aerators to determine baseline type – Some work done*
- ❑ *Add electric (if share in commercial building is substantial)*

Measure Consensus

6.18 – MF DHW Pump Control (On/off)



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- Offering

- MF only, Electric and gas water, heating, 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 Complex Size (\$37.10 or \$18.55/unit materials, \$2.68 or \$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

- Measure Extension

- Extend offering to POUs

- Stage 2 Issues

- *Consider more granular approach than only small and large buildings (currently savings per unit based on building sizes of 44 and 88 units)*
- *Extend to Commercial – SCG VFD DHW Pump WP in progress*

Measure Consensus

6.22 – Tank Insulation

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- Offering

- Commercial and Industrial, 1 inch or 2 inch insulation, Medium and High Temp tanks, Medium and Low Usage, Gas only, PreRebDown

- Stage 1 Issues

- Agree on Costs – Use PG&E/SCG WP costs from WP costs from vendor (McMaster Carr) 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

- Add Gas offering to POUs

- Stage 2 Issues

- TBD

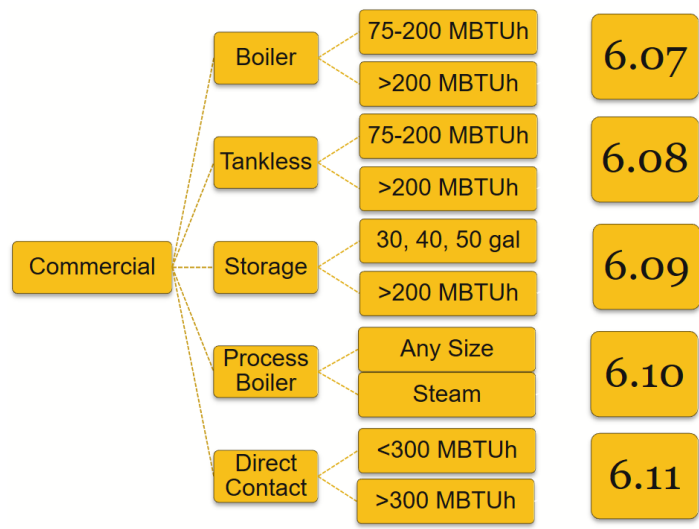
6.07 thru 6.16 – Hot Water Heaters and Boilers

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- 6.07 Boiler, Commercial
- 6.08 Tankless, Commercial
- 6.09 Storage Water Heater, Commercial
- 6.10 Boiler, Process
- 6.11 Direct Contact Water Heater, Process
- 6.12 Boiler, Multi-Family
- 6.13 Central Storage Water Heater, MF
- 6.14 Storage Water Heater, Residential
- 6.15 Tankless, Residential
- 6.16 Heat Pump Water Heater

Several Water Heater & Boiler Offerings and Tiers - Commercial

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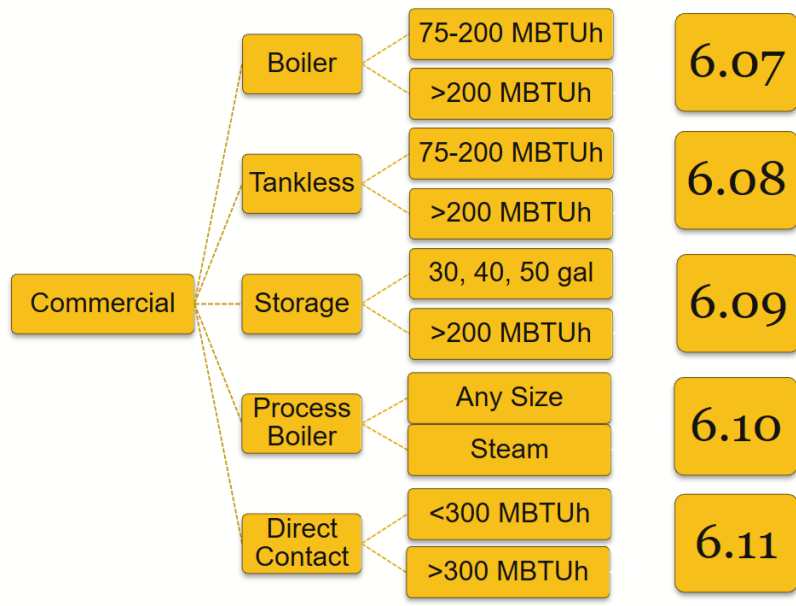


- Commercial Measures
- Current system has frequent mis-match in offerings and tiers (red)

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	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

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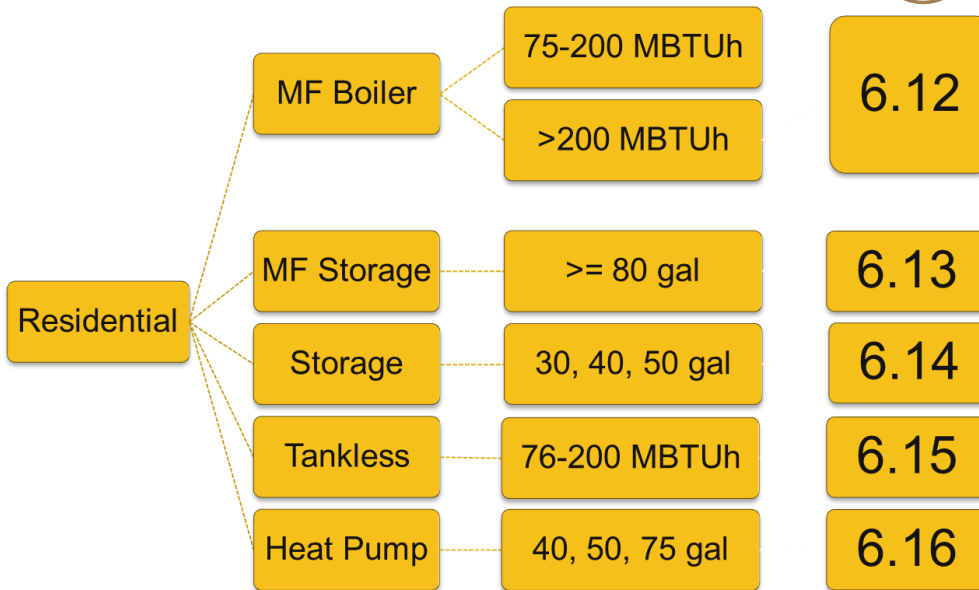


- Simplifying offerings and tiers
 - Lower tiers can be omitted from programs
- Match with Commercial where applicable
- For smaller commercial units, UEF values are being developed and we are planning to include those. Replacement of EF values may occur in Stage 2.
- **Impact: Harmonized approach; Continued alignment with changing measures.**

	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	<300MBTU/h	>= 88% AFUE
	Water Heaters	>300MBTU/h	>=90% TE

Several Residential Water Heater & Boiler Offerings and Tiers

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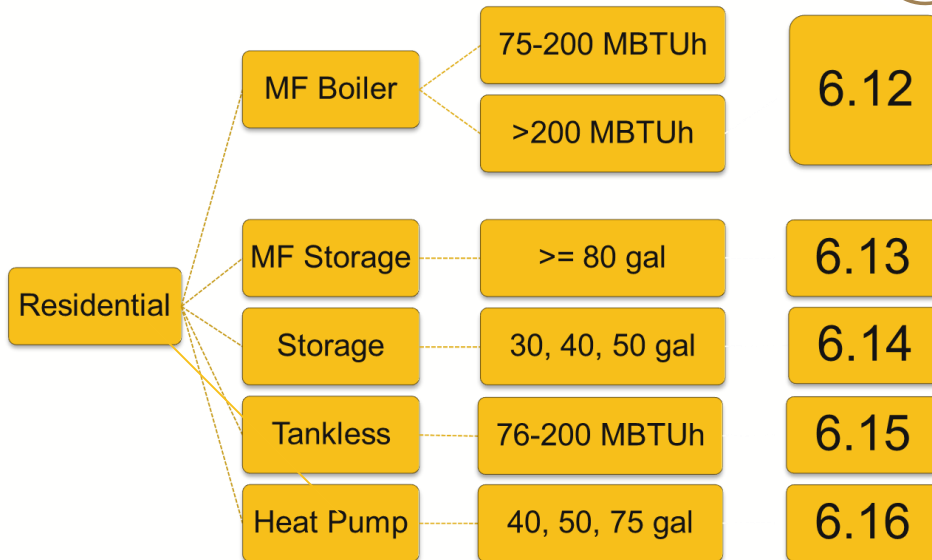
- Residential example
- Current system has frequent mis-match in offerings and tiers (red)

Existing Structure

	PG&E	SCG	SDG&E	SCE	Residential Capacity	Efficiency
6.12	x				MF Boiler	Small (>75MBTU/h)
	x					Small (75-200MBTU/h)
		x				Large (>200MBTU/h)
	x	x				
6.13		x			MF Storage	>80 Gal (>75MBTU/h)
		x				
	x					
6.14			x		Res Storage	30 Gal
			x			40 Gal
			x			40 Gal
			x			40 Gal
			x			50 Gal
			x			50 Gal
		x				30, 40, 50 Gal
		x				30, 40, 50 Gal
	x					Small (<75MBTU/h)
	x					
		x				
		x				
6.15					Res Tankless	Small (<200MBTU/h)
		x				
		x				Small (76-200MBTU/h)
		x				
	x					
						Large (>200MBTU/h)
6.16			x		Heat Pump	40 gal (min.)
			x			50 gal
			x			60 gal
			x			75 gal (and up)
	x					40 gal (min.)
	x					50 gal
	x					60 gal
	x					75 gal (and up)
	x					
		x	x			40 gal (min.)

Harmonizing Res Water Heater & Boiler Offerings and Tiers

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	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 Residential where applicable
- For residential units, UEF values are being developed and we are planning to include those. Replacement of EF values may occur in Stage 2.
- **Impact: Harmonized approach; Continued alignment with changing measures.**

6.07 to 6.16 – Hot Water Heaters / Boilers

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HEATERS ONLY - Storage (6.09 Commercial, 6.14 Residential)

- Storage Water Heaters - No tankless (moved PG&E WP Component) - WPs for (PG&E, SCG, SDG&E)
 - Res includes MF – Based on smaller in unit equipment
- Use DEER approved Calculator and Approach
 - Most Current: WaterHeater-Calculator v2.1.xlsm
 - Note that WP savings are based on WaterHeater-Calculator v1.1.xlsm
 - Limits to res and standard commercial building types and smaller sizes
 - Industrial and commercial use larger boilers and custom calculation
- Need to report on base and measure efficiencies used
 - Use updated base efficiencies – most recent WPs and highest measure efficiencies – pushing the market
- Can we collapse on climate zone (CZ) or comm building type?

6.07 to 6.16 – Hot Water Heaters / Boilers

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HEATERS ONLY - Storage (6.09 Commercial, 6.14 Residential)

- Conversion to UEF in calculator
 - ❑ Baseline efficiency = Code – **convert EF to UEF or use UEF required**
 - ❑ Measure efficiency – **convert EF to UEF**
- Other
 - ❑ Delivery – PreRebDown, DI for MF (PG&E?), mid and upstream options – **Allow all? GSIA and NTG implications**
 - ❑ Electric savings SDG&E Res only – **extend**
 - ❑ Most WPs use ROB only
 - ✦ **Extend to NC / NEW in future**
 - ❑ **Cost alignment**

6.07 to 6.16 – Hot Water Heaters / Boilers

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HEATERS ONLY - Heat Pump Water Heater (6.16)

eTRM #	PG&E	SCG	SDG&E	SCE	Technology	Capacity	Measure Efficiency	Base Efficiency (RET)	Recom. Efficiency (ROBNC)
6.16			x		Heat Pump WH	40 gal (min.)	EF=2.0	.92 EF el res st tank only	EF = 0.95
6.16			x			50 gal	EF=2.0	.90 EF el res st tank only	EF = 0.95
6.16			x			60 gal	EF=2.0	.89 EF el res st tank only	EF = 1.99
6.16			x			75 gal (and up)	EF=2.0	.87 EF el res st tank only	EF = 1.97
6.16	x					40 gal (min.)	EF=2.0	.88 EF el res st tank only	
6.16	x					50 gal	EF=2.0	.88 EF el res st tank only	
6.16	x					60 gal	EF=2.0	.87 EF el res st tank only	
6.16	x					75 gal (and up)	EF=2.0	.87 EF el res st tank only	
6.16	x		x	x		40 gal (min.)	EF=2.0	EF = 0.948 (new T20)	

*Note – Recommended efficiencies are for a ROB / NEW (NC) baseline
If RET/ER, efficiencies based on older T20 requirements
(e.g., PG&E workpapers) seem appropriate for the first 1/3 of
20 year EUL period.*

6.07 to 6.16 – Hot Water Heaters / Boilers

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Heat Pump Water Heater (6.16)

- Heat Pump Water Heater – Electric Only
 - Some Similar Issues to other Storage Heaters –
 - Uses Mix of DEER results and custom calculations
 - Wide array of savings approaches – hardest consolidation
 - 2 WPs for Residential (SCE, SDG&E), 1 Workpaper for Residential and Residential Sized units in Commercial Applications (PG&E)
 - ✦ EXPAND TO ALL C&I and AG? How do we deal with HOU / profile?
 - Measure Min. Eff. - what is available in the CA market? Or code?
 - ✦ ENERGY STAR referenced in WPs, requires EF = 2.0 minimum (QE?)
 - ✦ Actual baseline EF is ≥ 3.00 (Msr efficiency?)
 - All ROB offerings – some NC also. Include NC?
 - Include RET / ER baseline?
 - Standardize on offering – size of tank (50 gallon)
 - ✦ Expand in Phase 2 if needed
 - PreRebDown (Downstream Rebate)
 - Can we collapse on Climate zone (CZ) or comm building type?

6.07 to 6.16 – Hot Water Heaters / Boilers

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HEATERS ONLY - Instantaneous (6.08, 6.15)

Consolidate on Instantaneous vs. tankless and Large units > 210,000 btuh - conform with T20 codes

- Similar Issues to Storage Heaters – uses calculator
- No SCE workpapers and No SDG&E residential – limited electric saving potential. No electric calcs. **Gas Measure Only.**
- Large Units overlap with Boilers – rated in TE (thermal efficiency) UEF changeover ruling does not apply to larger units.
- Other
 - ❑ Delivery – PreRebDown Preferred, DI for MF (PG&E?), mid and upstream options – Allow all?
 - ❑ ROB and NC for SCG Commercial Large only – All NC and ROB ?
 - ❑ Does and RET/ER option exist, especially for MF DI?
 - ❑ Can we collapse on Climate zone (CZ) or comm building type?

6.07 to 6.16 – Hot Water Heaters / Boilers

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BOILERS – Commercial and MF (6.07, 6.12, 6.13)

- Overlap with Instantaneous
 - ✦ **BOILERS ARE > 300 kbtuh and <1250 kbtuh AND >4 kbtuh / gal. storage**
- **PG&E COMMERCIAL WP (6.07) CONTAINS MF – Move to 6.12**
 - ✦ **MF has different use profile than other commercial (but all types differ)**
- 6.11 – commercial - Use values calculated in DEER for commercial building types
 - ✦ Possible collapse on Climate Zone
- 6.12 MF boilers – Calculation in WP – replicate equations in data spec
- 6.13 Central Storage WHs - Calculation in WP – replicate equations in data spec
 - ✦ Tier 1 Qualifying efficiency – 83% or 82% - 83% in approved Wp
- Other
 - Delivery – PreRebDown, PreRebUp - **Allow all?**
 - ROB and NC for SCG Commercial Large only – **All NC and ROB ?**
 - **Does any RET/ER option exist, especially for Condensing Boilers?**
 - **85% for condensing boiler in DEER?**

6.07 to 6.16 – Hot Water Heaters / Boilers

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PROCESS ONLY (6.10 and 6.11)

3 WPs Process Boilers (PG&E, SCG, SDG&E) – SCG/SDG&E WPs very similar

1 WP Direct Contact Water Heaters (PG&E) Uptake?

SCG /SDG&E Boiler WPs place DCWHs in Tier 2 for Process Boilers

>90% qualifying efficiency (QE), 94.4% in savings calcs

- ❑ Include as separate eTRM measures.
- ❑ Replicate calculations in eTRM.
- ❑ Use PG&E approach for DCWH – only approved WP.
 - ✦ High measure efficiency of 98% may drive market.
 - ✦ Disagrees with *implied DCWH efficiency of 94.4% above*
 - ✦ *Uses capacity factor of 0.419 (41.9%) used for process boilers*
 - Based on published source - ORNL study (May 2006)
 - Weighted for CA boiler representation in six industry types

6.07 to 6.16 – Hot Water Heaters / Boilers

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PROCESS BOILERS (6.10) - Recommendations

- ❑ Replicate calculations in eTRM - SCG calcs use operating hours (~50% varies by size) and load factor (~30%) to get CF
- ❑ Use PG&E formula (similar) for Process Boilers for consistency
 - ✦ *Uses capacity factor of 0.419 (41.9%) used for process boilers*
 - *Based on published source - ORNL study (May 2006)*
 - *Seems to include hours of operation based on Table B-1*
 - SCG data based on MAS data in 2005 – Survey data? No raw data available – may not be applicable to all CA.

Industry	Capacity Factor	Number of Boilers	% of CA industry GDP vs nationwide industry GDP	Estimated number of boilers per industry in CA	Weighting factor
Food	0.31	10,610	9.70%	1,030	25.7%
Paper	0.66	3,460	4.30%	150	3.7%
Chemicals	0.50	11,980	8.80%	1,050	26.2%
Refining	0.25	1,200	21.50%	260	6.5%
Metals	0.47	3,330	4.50%	150	3.7%
Other Manufacturing	0.44	12,435	11.05%	1,370	34.2%
Totals		43,015		4,010	100.0%
Average Capacity Factor	0.419				

6.07 to 6.16 – Hot Water Heaters / Boilers

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PROCESS BOILERS (6.10) - Recommendations

- ❑ Change in values - Use condensing and non-condensing tiers (T1 and T2) for combustion efficiency (CE) – hot water boilers
 - SCG T1 >85% QE, 85.5% (avg.) in savings calcs
 - SCG T2 >90% qualifying efficiency (QE), 93.9% (avg.) in savings calcs – based on size - Condensing
 - PG&E T1 only >83% qualifying efficiency (QE), 88.4% in savings calcs (averages – all from program data or CEC data?)
- ❑ Steam Boilers – measure combustion efficiency (CE) – one tier
 - SCG >83% QE, 83% and 83.2% in savings calcs (based on size)
 - PG&E >83% QE, 83% in savings calcs
 - Standardize on 83%

Measure Efficiencies

Hot Water	Hot Water	Hot Water	Hot Water	Hot Water	Steam	Steam	Steam
PG&E All					PG&E All		
Sizes	≤2 MMBH	2-10 MMBH	≤2 MMBH	2-10 MMBH	Sizes	≤2 MMBH	2-10 MMBH
Combined							
Tier	Tier 1	Tier 1	Tier 2	Tier 2	Tier 1	Tier 1	Tier 1
88.4%	85.6%	85.5%	94.4%	93.4%	83.0%	83.2%	83.0%

6.07 to 6.16 – Hot Water Heaters / Boilers

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PROCESS BOILERS (6.10) - Recommendations

- HW Boiler Baseline CE (82% PG&E – 80% SCG)
 - ✦ Does T20 code apply to process boilers – definition of boiler?
- Steam Boiler Baseline CE 82% (80% TE)
 - *82 CE (T20 - TE = 79%, 77% w/nat. draft) --- Need two categories? Modify in Phase 2? Easy to make change now but deviates from WP.*
- All Boilers
 - ✦ CZ variation in SCG WP – based on several assumptions – not in PG&E WP - expand for CZ in phase 2? Revisit assumptions?
 - Replicated in Data Spec already
 - ✦ NAICS 11, 21, 31, 32, 33, 8123 -- extend to any process applications as for SCG WP?
 - Is CF used by PG&E widely applicable?
 - ✦ Revisit other sources for CF (Case 2011 study for Process Boilers – Phase 2)

General rule – Thermal Efficiency (TE) = Combustion Efficiency (CE) – 2%

6.17 to 6.19 – Controls

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DHW Pump and Boiler Controls

- ❑ 6.17 – DHW Controls Boiler Temp Reset controller – 1 WP (PG&E)
 - ✦ MF and lodging
 - ✦ Temperature reset – Gas savings
 - ✦ Combine with 6.19
 - ✦ Use PG&E approach for savings and RASS usage (simple equation with reduced loop temperature)
 - ✦ SCG used eQuest models (not available or yet reviewed)

6.20 to 6.22 – Insulation

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- 6.20 MF Central Recirc System Pipewrap – 1 WP (SDG&E) – SCG WP not in use
 - ✦ MF only
 - ✦ No Climate Zone Dependency (CZ)
 - ✦ SCG Combines with 6.21 (same HOU and DHW service)

Removed as no IOU offerings

6.20 to 6.22 – Insulation

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DHW Insulation

• 6.21 Hot Water Line Insulation Electric/Gas - 3 WPs (PG&E, SCG, SDG&E)

- ✦ Commercial Only
- ✦ Hot Water and Steam (SDG&E) – Title change?
- ✦ All – 1 inch insulation on ½ - 4” pipe OK?
- ✦ ALL IOUs - PreRebDown (and DI for SDG&E)
- ✦ ALL IOUs – REA/AOE measure – SDG&E states this applies to damaged insulation – R4818 implications for existing conditions?
- ✦ Climate Zone Dependency
- ❑ Costs \$5.22/LF but \$12.18/LF for PG&E (from MCS)
 - ✦ Vary with Size

Verify Electric Savings – extend to SCE / POUs?

Reference SCG standalone tool in eTRM / incl with documentation

6.01 thru 6.22 – Hot Water Measures

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- Remaining Issues – Cross Cutting
 - 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 R.4818 / AB802
 - Addressing embodied energy in water – water reduction given for some measures - varies by location – Stage 2? SDG&E workpaper?
 - Partial exclusion (or total) when buildings have functional solar water heaters?

6.01 thru 6.22 – Hot Water Measures

Other New Measures – Phase 2

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- 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 – Phase 2 (2018)

HW Heating Measures – Electric Savings

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- Claiming Electric Savings
 - ❑ SCE claims only electric savings for the % market share electric for flow reduction measures – presumably the gas savings can be claimed by gas utilities – is this more accurate than calculating savings directly?
 - ❑ Currently electric savings calculated based on conversions from gas savings

SHW / DHW Measures

Representative Measure Savings Claims

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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.

6.01 thru 6.22 – Hot Water Measures

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NEXT MEETING DATE

Dec. 21, 2017 @ 1 PM

Maybe Tuesday 12/19?

Ad Hoc by email as needed?

Questions?

Next Steps?