

DOCKETED

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Title 20 Appliance Efficiency Regulations: Showerhead Proposal

Presented by: Sarah Schneider, Energy Solutions
On behalf of the Statewide Utility Codes and Standards Enhancement Program

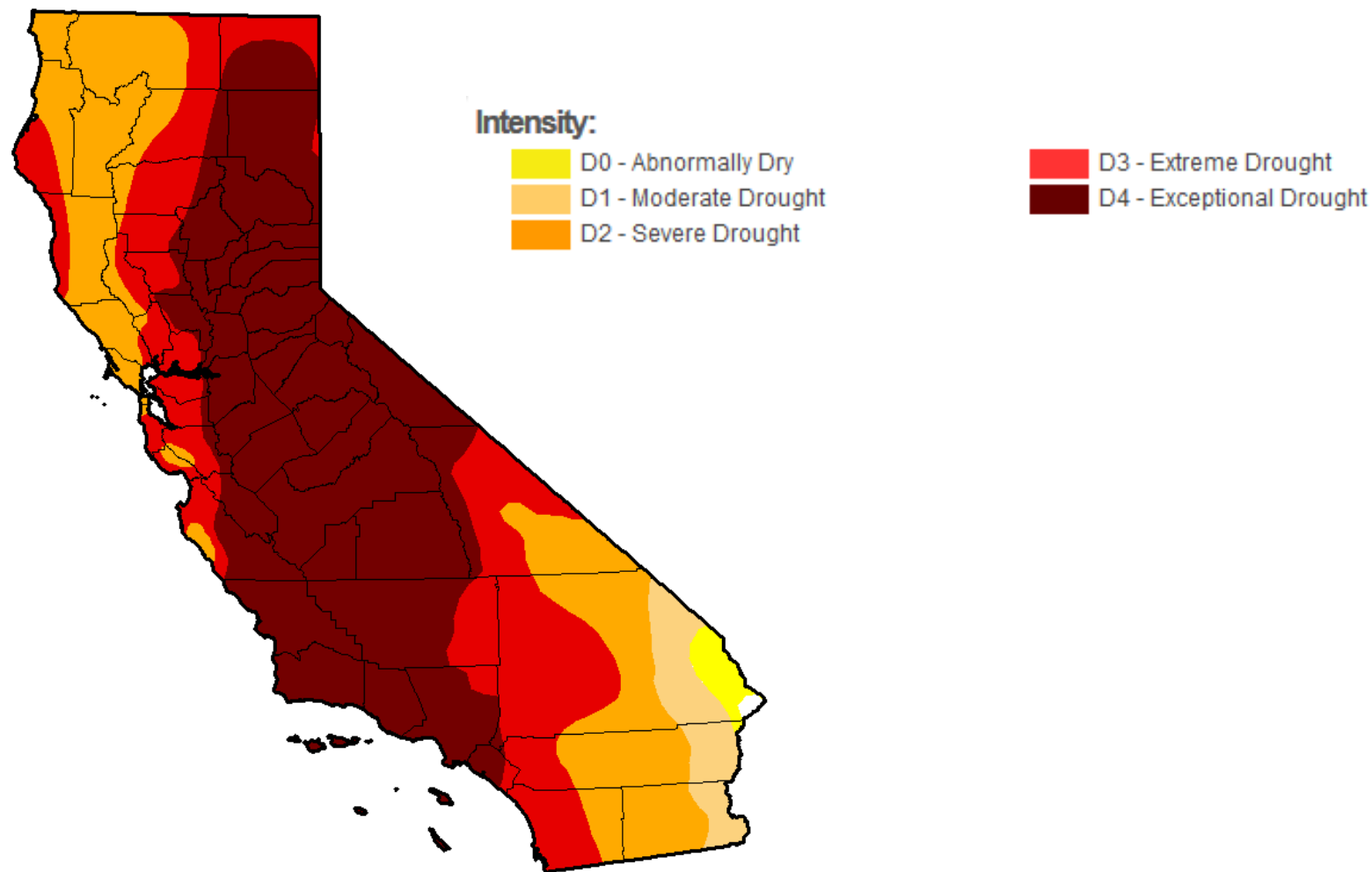
CEC Public Workshop
July 28, 2015
Docket No. 15-AAER-01



Background

- Investor-Owned Utilities (IOU) directed by California Public Utilities Commission (CPUC) to pursue water efficiency through codes and standards advocacy
- Current California standard (**2.5 gpm at 80 psi**) was last updated in 1992.
- In December 2010, DOE waived preemption for showerheads, allowing California (and other states) to adopt more stringent standards.
- The City of Los Angeles (population: 3.8 million) and New York City (population: 8.4 million) set standards at **2.0 gpm at 80 psi** (similar to WaterSense levels) (LA effective December 2009, NY in July 2012)
- California has an opportunity to save water and energy—and reduce utility bills—through an updated showerhead standard.

California's Drought Emergency

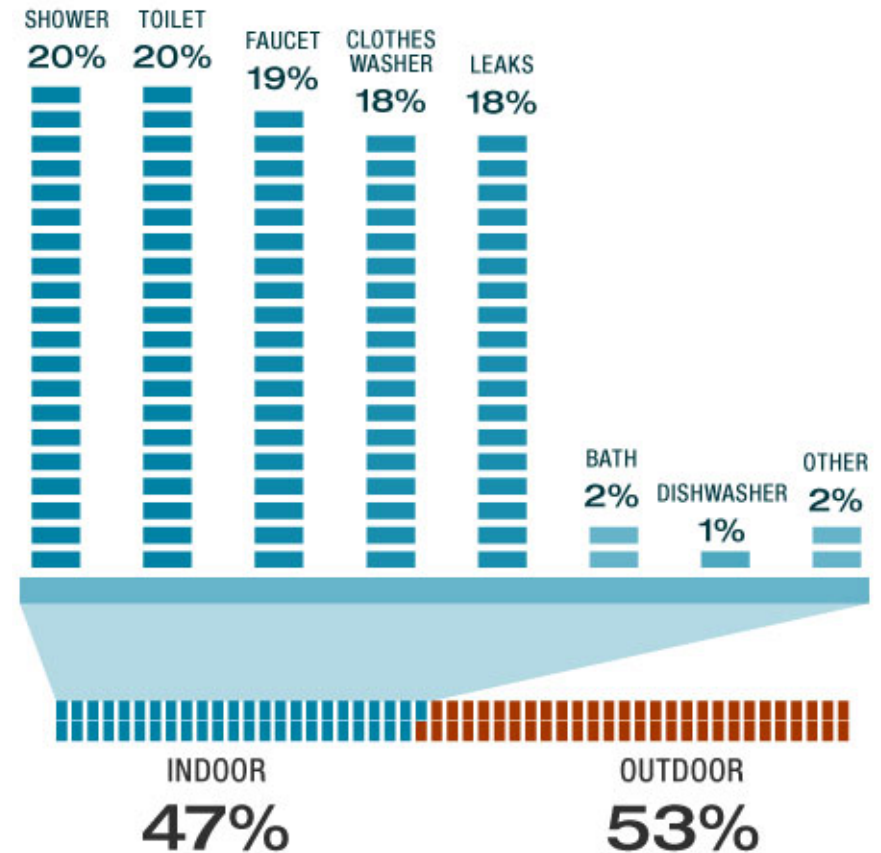


Source: United States Drought Monitor (Updated June 30, 2015)



Rationale

- **California consumes ~2.9 trillion gallons per year for urban uses (indoor and outdoor)**
 - 2.6 terawatt hours of embedded electricity
- **Showers are one of largest residential indoor water uses**
 - 20% of indoor uses
 - 73% of shower water is hot water. Water heating accounts for largest share of natural gas usage in California homes



Source: CEC. <http://www.energy.ca.gov/drought/rebate/>

Standard Proposal: Showerheads

Water Pressure (psi)	Maximum Flow Rate (gpm)		Minimum Flow Rate (gpm)
	Tier 1	Tier 2	
80 psi	2.0 (WaterSense level) (LA & NYC level) 	1.8	N/A
45 psi			75 percent of maximum flow rate
20 psi			60 percent of maximum flow rate
Effective Date:	January 2016	2 years after Tier 1	

Additional Requirements:

- Performance standards for spray coverage and spray force
- Reporting requirements to include minimum flow rates
- Labeling requirement for shower mixing valves
- Labeling requirement to prevent manufacturers from providing instructions directing user to alter the maximum flow rate

Harmonization

- **Harmonization with existing state laws and regulations**
 - CA Plumbing Code (2.0 gpm new construction)
 - 2013 CALGreen (2.0 gpm new construction)
 - California Senate Bill 407 (2009) (existing buildings)
- **Industry support for WaterSense**

PMI Urges Immediate Use of EPA WaterSense Products in California

April 10th, 2015 | Author: Maureen Baird
Topics: [California Drought](#), [Water Efficiency](#)

Share this Article



Source: <https://www.safeplumbing.org/discussion/article/pmi-urges-immediate-use-epa-watersense-products-in-california>

Product Availability

Showerheads in DOE's Compliance Certification Database

Level	Brands			Unique Model Numbers	
	Number	Percentage		Number	Percentage
Tier 1 levels (≤ 2.0 gpm)	79	65%		2,145	45%
Tier 2 levels (≤ 1.8 gpm)	51	42%		613	13%
Non-qualified (> 2.0 gpm)	42	35%		2,594	55%
Total	121	100%		4,739	100%

Source: CASE Team analysis 2015

Estimated Annual Savings per Showerhead

Efficiency Level	Water Savings (gallons/yr)	Energy Savings from Reduced Water Heating Load*		Embedded Electricity Savings (kWh/yr)	Peak Demand Savings (W)
		Natural Gas Savings (therms/yr)	Electricity Savings (kWh/yr)		
Tier 1 Savings (2.5gpm to 2.0 gpm)	2,175	13	250	11	33
Tier 2 Savings (2.0 gpm to 1.8 gpm)	899	5	104	4	14
Total Proposed Savings (2.5 gpm to 1.8 gpm)	3,074	18	354	15	47

* Each showerhead will have either natural gas or electricity savings depending on whether the house has natural gas or electric water heating.

Estimated Annual Statewide Savings

Year	Water Savings (million gal/yr)	Natural Gas Savings ^a (million therms/yr)	Electricity Savings ^a (GWh/yr)	Embedded Electricity Savings (GWh/yr)	Peak Demand Savings (MW)
Tier 1 Standard Only (2.5gpm to 2.0 gpm)					
First year (2016)	2,215	11	27	11	3.6
Full replacement ^b	23,057	118	279	112	37
Tier 2 Standard incremental (2.0 gpm to 1.8 gpm)					
First year (2018)	1,386	7	17	7	2.3
Full replacement ^b	14,171	73	174	69	23
Tier 1 and Tier 2 Standards (2.5 gpm to 1.8 gpm)					
Full replacement*	37,552	193	456	182	61
Annual water/energy consumption equivalencies of average California homes	Water use of 277,540 California homes	Natural gas use of 540,725 California homes	Electricity use of 71,850 California homes	Electricity use of 28,670 California homes	

* Full replacement savings estimates represent the savings from all products that have been sold since the standard took effect, and represents the full savings potential after all non-qualifying products have been replaced with products that meet the proposed Tier 2 standard.

Estimated Annual Statewide GHG Reductions

Year	Stock GHG Savings (MTCO ₂ e/yr)
Tier 1 Standard (2.5gpm to 2.0 gpm)	
First Year (2016)	86,911
Full replacement*	904,901
Tier 2 Standard incremental (2.0 gpm to 1.8 gpm)	
First Year (2018)	55,045
Full replacement*	562,697
Tier 1 and Tier 2 Standards (2.5 gpm to 1.8 gpm)	
Full replacement*	1,480,341

* Full replacement savings estimates represent the savings from all products that have been sold since the standard took effect, and represents the full savings potential after all non-qualifying products have been replaced with products that meet the proposed Tier 2 standard.

Source: CASE Team analysis 2015

MTCO₂e = metric tons of carbon dioxide equivalent

Lifecycle Costs and Benefits – Per Showerhead

Product Class	Per Unit Present Value Cost ^a	Lifecycle (10-year) Per Unit Present Value Benefits ^b				
		Water Cost Reduction ^c	Electricity Cost Reduction ^d	Natural Gas Cost Reduction ^e	Total Cost Reductions if Electric Water Heating ^f	Total Cost Reduction if Natural Gas Water Heating ^g
Tier 1 (2.5 gpm to 2.0 gpm)	\$0.00	\$179	\$436	\$140	\$615	\$319
Tier 2 incremental (2.0 gpm to 1.8 gpm)	\$0.00	\$77	\$187	\$62	\$264	\$139
Tier 1 & 2 (2.5 gpm to 1.8 gpm)	\$0.00	\$256	\$623	\$202	\$879	\$458

Source: CASE Team analysis 2015

Notes:

- PV = Present Value. Calculated using CEC's average statewide PV statewide energy rates that assume a 3% discount rate (CEC 2012). Incremental cost is the cost difference between the baseline non-qualifying product and the qualifying product. There are no additional maintenance costs for qualifying products.
- Cost savings will be realized through lower electricity, gas, and water bills. Average annual electricity, gas and water rates were used, starting in the effective year. The analysis does not include cost savings associated with embedded energy savings.
- Water savings apply to all showerheads regardless of the type of water heater.
- Electricity savings only apply to showerheads installed in homes that have electric water heating.
- Natural gas savings only apply to showerheads installed in homes that have natural gas water heating.
- Includes cost savings from reduced water use and reduced electricity use for water heating.
- Includes cost savings from reduced water use and reduced natural gas use for water heating.

Statewide Total Lifecycle Costs and Benefits ^a

Standard Level	Lifecycle Benefit / Cost Ratio ^b	Net Present Value (\$)	
		For First Year Shipments (\$ million)	Stock Turnover (\$ million)
Tier 1	N/A	\$353M	\$4,059M
Tier 2	N/A	\$232M	\$2,630M
Tier 1&2	N/A	\$585M	\$6,679M

Notes:

- a. The analysis does not include cost savings associated with embedded energy savings.
- b. Total present value benefits divided by total present value costs. Positive value indicates a reduced total cost of ownership over the life of the appliance. The Benefit/Cost Ratio is not applicable for showerheads because there is no incremental cost.

Conclusion

- **Opportunity for CEC to adopt meaningful standards**
- **We recommend CEC adopts a two-tiered standard:**
 - Tier 1 (effective January 2016): 2.0 gpm maximum determined by testing at 20, 45, and 80 psi (WaterSense / NYC / LA)
 - Tier 2 (effective two years after Tier 1): 1.8 gpm maximum determined by testing at 20, 45, and 80 psi
 - Additional performance, reporting, and labeling requirements
- **A significant number of brands and models are already available to meet both the Tier 1 and Tier 2 standards.**
- **Standards will cost-effectively save a significant amount of water and energy.**
- **Additional details are included in the Statewide Utility Codes and Standards docketed Showerheads CASE report.**

Title 20 Appliance Efficiency Regulations: Lavatory Faucets

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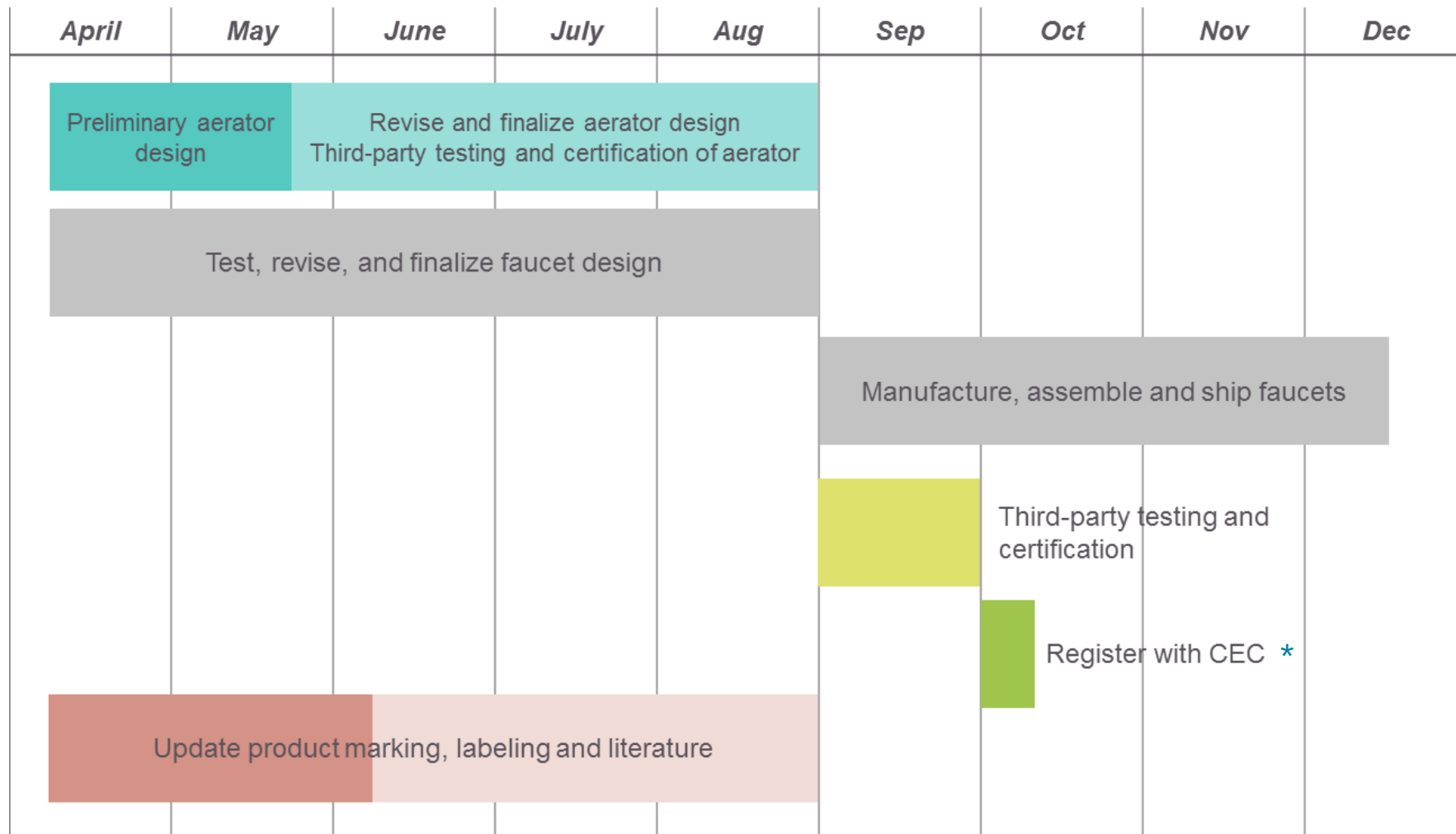
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Summary

- IOUs support PMI's proposal for 1.5 gpm effective immediately.
- IOUs support CEC maintaining 1.2 gpm effective date of January 1, 2016
- **Product Availability:** 6 manufacturers have 92 unique models of faucet aerators at 1.2 gpm or less certified in the DOE product certification database (July 22, 2015)
- **Product Development & Production:**
 - Full faucet re-design not necessary
 - Aerator sizing, threading generally standardized
 - Major aerator manufacturer is prepared for increasing 1.2 gpm shipments
 - Product certification can be completed within 90 days, some certifying bodies provided estimates that certification can be completed within 30 days

Alternative Product Development Schedule



*CEC Database Certification: IOUs recommend CEC prioritize and streamline plumbing products database certification to ensure expedited compliance.

Questions?

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APPENDIX

Assumptions: Water and Energy Savings – Per Showerhead

Metric	Value	Source / Notes / Equations
Average shower duration [A]	8.7 minutes/shower	DWR 2011
Average number of showers per household per day [B]	1.97 showers/household/day	DWR 2011
Shower days per year [C]	365 days/yr	
Showerheads per household [D]	1.19 showerheads/household	DWR 2011 and CASE Team analysis. DWR 2011 found 1.3 showers per single-family house. Assumed 1 showerhead per multi-family unit and mobile unit.
Non-qualifying flow rate at 80 pounds per square inch (psi) [E]	Tier 1: 2.5 gallons per minute (gpm) Tier 2: 2.0 gpm	Tier 1: Current federal standard Tier 2: Proposed Tier 1 Title 20 efficiency standard
Qualifying flow rate at 20, 45, or 80 psi [F]	Tier 1: 2.0 gpm Tier 2: 1.8 gpm	Proposed Title 20 maximum flow rates
Flow rate derating factor [G]	0.86	DWR 2011
Additional water wasted when waiting for hot-enough water to arrive, relative to 2.5 gpm showerhead [H]	71.9 gallons per showerhead per year	$0.1 \text{ gallon per event} \times B \times C$
Percent of water use that is hot [I]	73.1%	Seattle & EPA 2003

Source: CASE Team analysis 2015

Assumptions: Per Unit Water and Energy Savings – Per Showerhead (continued)

Metric	Value	Source / Notes / Equations
Natural gas required to heat water [J]	8.133 therms/1000 gallons	- Assumes cold water inlet temperature is 65°F and hot water supply is 124°F (CA IOUs 2011, CEC 2013) - Assumes average Energy Factor rating of gas storage water heaters is 0.60 (CPUC 2014). - Assumes water is at 100°F and 1 atm
Electricity required to heat water [K]	158.9 kWh/1000 gallons	- Assumes cold water inlet temperature is 65°F and hot water supply is 124 °F (CA IOUs 2011, CEC 2013) - Assumes average energy factor of electric storage water heaters is 0.90 (CPUC 2014). - Assumes water is at 100°F and 1 atm
Embedded Electricity Factor [L]	4,848 kWh/million gallons	CPUC 2015
Peak demand load factor [M]	0.86	Brown & Koomey 2002

Source: CASE Team analysis 2015

Assumptions: Water and Energy Savings - Statewide

Metric	Value	Source / Notes
Showerheads sold during first year standard is in effect ^b [A]	Tier 1 (2016): 1,696,827 Tier 2 (2018): 1,752,557	
Percent of showerheads expected to meet proposed efficiency level without standard [B]	Tier 1: 40 percent Tier 2: 12 percent	
Percent of households with Natural Gas Water Heating [C]	87.1 percent	CPUC 2014
Percent of Households with Electric Water Heating [D]	7.3 percent	CPUC 2014
Percent of households with no water heater, other water heating source (e.g. propane, solar) [E]	5.6 percent	CPUC 2014

Source: CASE Team analysis 2015

California Shipments and Stock of Showerheads

- Projected number of showerheads that will be replaced in existing buildings and that will be installed in new construction
- Quantity of shipments varies proportionally to forecasted housing stock
- Assumes:
 - 10% annual replacement (10%) of installed stock replaced each year
 - 1.3 showerheads will be installed in new single family homes
 - 1 showerhead will be installed in new multi-family and mobile dwelling units

Year	Annual Shipments (units)	Stock (units)
2015	1,715,385	15,447,977
2016	1,696,827	15,265,333
2017	1,707,281	15,428,602
2018	1,752,557	15,945,351
2019	1,756,696	16,092,381
2020	1,768,848	16,236,774
2021	1,779,963	16,378,223
2022	1,789,058	16,514,884
2023	1,797,894	16,647,295
2024	1,804,474	16,773,483
2025	1,813,337	16,897,110
2026	1,822,028	17,017,398
2027	1,830,562	17,134,509
2028	1,838,960	17,248,609

Source: CASE Team analysis 2015

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