

# Subcommittee Meeting #3

## Appliance/Plug Load



**CALIFORNIA**

TECHNICAL FORUM

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# Objective

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- Address existing Appliance/Plug Load measures that would migrate to the eTRM
  - Reconcile differences between IOU workpapers
  - Address issues with DEER values
  - Align IOU and POU methodologies/values
  - Look for opportunities to consolidate/simplify measures where appropriate.

# Meeting #3 Agenda

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- Recap Meeting #1 and #2
- Discuss Follow-up items from prior meetings
- Review and (hopefully) close measures
  - ☐ Clothes Washers
  - ☐ Clothes Dryers
  - ☐ Retail Products Platform
  - ☐ Dishwashers
  - ☐ Vending Machine Controllers
  - ☐ PC Power Management
- Review 1 new measure
  - ☐ Ozone Laundry

# Meeting #1

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- Discussed following measures
  - Smart Power Strips (Tier 1 and Tier 2)
  - Retail Products Platform
  - PC Power Management
  - ENERGY STAR Refrigerators
  - Appliance Recycling

# Meeting #1 follow-up items

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- RPP
  - Do further research on multi-state aspects of program
  - Look at potential evaluation impacts if RPP is split into measures
- PC Power Management
  - Review evaluations, other research to inform position regarding annual savings degradation factor
- Smart Power Strips
  - Review CalPlug specifications and test approach
- ENERGY STAR Refrigerators
  - Come to resolution regarding “DEER Adjustment Factor”

# Meeting #2

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- Agenda

- Continue discussion on RPP
- Review Additional Measures
  - ✦ ENERGY STAR Clothes Washers
  - ✦ ENERGY STAR Clothes Dryers
  - ✦ ENERGY STAR Dishwashers
  - ✦ Vending Machine and Beverage Case Control
- Follow-up discussion topics
  - ✦ PC Energy Management
  - ✦ Smart Power Strips
  - ✦ ENERGY STAR Refrigerators

# Meeting #2 follow-up

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- Review EAR disposition for Clothes Washer Recycling
  - Cycles/yr determinations for that measure
  - Potential applicability to ENERGY STAR Clothes Washer measure

# Follow-up - Refrigerators

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- ENERGY STAR Refrigerators
  - DEER Basis Factor in work papers
  - Traced origin to 2012 document
    - ✦ Part of DEER 2011 documentation
    - ✦ “DEER Weighted and Scaled Measures”, May 20, 2012
  - Apparent intent is to address interactive energy impacts between refrigerator and home
    - ✦ Refrigerator performance is function of space temperature
    - ✦ Refrigerator emits heat that impacts HVAC



# Refrigerators (cont'd)

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The energy impacts associated with residential refrigerator and freezer measures are determined by the measure technology DOE-rated annual energy use (kWh/yr):

- kWh savings =  $WB\_EnImpact \text{ (kWh}/\Delta\text{RatedkWh)} * Meas\_ \Delta\text{RatedkWh}$
- kW savings =  $WB\_DemImpact \text{ (kW}/\Delta\text{RatedkWh)} * Meas\_ \Delta\text{RatedkWh}$
- therm savings =  $WB\_GasImpact \text{ (therm}/\Delta\text{RatedkWh)} * Meas\_ \Delta\text{RatedkWh}$

where:

- $WB\_EnImpact$  = normalized whole building electricity savings (kWh/ $\Delta$ RatedkWh) as stored in the energy impacts table.
- $WB\_DemImpact$  = normalized whole building electric demand (kW/ $\Delta$ RatedkWh) as stored in the energy impacts table.
- $WB\_GasImpact$  = normalized whole building gas savings (therm/ $\Delta$ RatedkWh) as stored in the energy impacts table.
- $Meas\_ \Delta\text{RatedkWh}$  = Measure “delta” rated annual kWh, defined as (Base technology rated annual kWh – Measure technology rated kWh); there are separate values for above-code and above pre-existing cases. These values are stored as part of the measure definition or are calculated based on the technology references that are part of the measure definition.

*Source: DEER Scaled and Weighted Measures, page 3*

# Refrigerators (cont'd)

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- Still some uncertainty regarding whether this factor is accurate
  - Factor is derived from building simulations
  - DEER team developed performance adjustment to address refrigerator energy consumption as function of space temperature
  - Unclear how (or if) DEER addresses behavioral interactions (e.g., door openings)
- Proposal: recommend migrating to eTRM, but continue to research adjustment factor

# Cross-Cutting Issue

## Retail Products Platform (RPP)

- Subcommittee discussed, and potentially agreed:
  - Each product under RPP would be established as a measure in eTRM
  - There would be a unique delivery identifier for RPP
    - ✦ Would allow assignment of values unique to RPP
      - NTG
      - ISR
    - ✦ Would preserve aspects of RPP program delivery within eTRM
      - Support evaluation process
      - Allows flexible measure management within eTRM

# 7.05 – Energy Star Clothes Washers

- Main follow-up topic from last call was resolving annual cycles
  - EAR Team disposition for clothes washer recycling identifies different values than those used by USDOE
  - Paper was circulated to subcommittee by Roger
    - ✦ EAR disposition notes that DEER relies on USDOE methodology for new clothes washer savings
      - Aligns UEC values for base and measure equipment
      - Ensures that savings values are not based on differences in determination
    - ✦ Similar argument can be made for clothes washers in MF common area laundries and laundromats
      - USDOE values based on multiple studies, including several from California

# 7.04 – Energy Star Clothes Dryers

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- Workpaper Differences (Standalone vs. RPP)
  - Savings methods aligned between workpapers
    - ✦ Rely on DOE methods
    - ✦ RPP savings corrected in compliance revision to incorporate final moisture content per DOE test procedure, plus use interactive heat gain guidance from Staff
  - Minor difference in permutation quantity
    - ✦ Standalone Dryer template has single value for all dryers
    - ✦ RPP has 13 permutations
    - ✦ It appears that the RPP dryer is more developed in this regard
  - Minor differences for costs
    - ✦ Tier 1 Incremental Cost
      - \$49.50 for standalone Dryer measure
      - \$84 for Dryer in RPP
  - Different NTG
    - ✦ 0.55 for ENERGY STAR dryer - standalone
    - ✦ 0.70 for ES Emerging Technology Award dryer – standalone
    - ✦ 0.20 for dryers under RPP (per Staff Disposition)

# 7.04 – Energy Star Clothes Dryers

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- Recommendation – Where workpapers differ,
  - Adopt RPP Dryer Measure calculations
  - Adopt RPP Dryer Measure costs
  - Adopt Standalone Dryer NTG ratios for non-RPP delivery mechanisms
    - ✦ RPP NTG trajectory is likely outside scope of this subcommittee

# 7.12 – Energy Star Dishwasher

- Measure is in DEER
  - ✦ Negative kWh savings
  - ✦ Mixed kW reductions
  - ✦ Positive Therm savings
  - ✦ Unclear what methodology/source was used to achieve these values
- Measure is in POU TRM
  - ✦ ENERGY STAR qualified dishwashers
    - 37 kWh/yr (electric water heater)
    - 16 kWh/yr, 0.93 therm/yr (gas water heater)

# 7.12 – Energy Star Dishwasher

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- ❑ Follow-up from Last Call
  - ✦ SCG provided work paper
    - Focuses on dishwashers with Estimated Annual Energy Use (EAEU) of 199 kWh or less
    - Interpolates DEER 180 kWh and DEER 260 kWh values from READI
- ❑ Propose migrating to eTRM with 3 tier permutations
  - ✦ ENERGY STAR
  - ✦ ENERGY STAR Most Efficient
  - ✦ 199 kWh or less (Top Efficiency)



## 7.18 – Vending Machine Controller

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- ❑ POU TRM relies on same data as other states' TRMs to arrive at much larger savings versus Work Paper
- ❑ Massachusetts TRM notes that measure is not eligible for installation on ENERGY STAR qualified vending machines, as they already have control capability built-in

### Proposal:

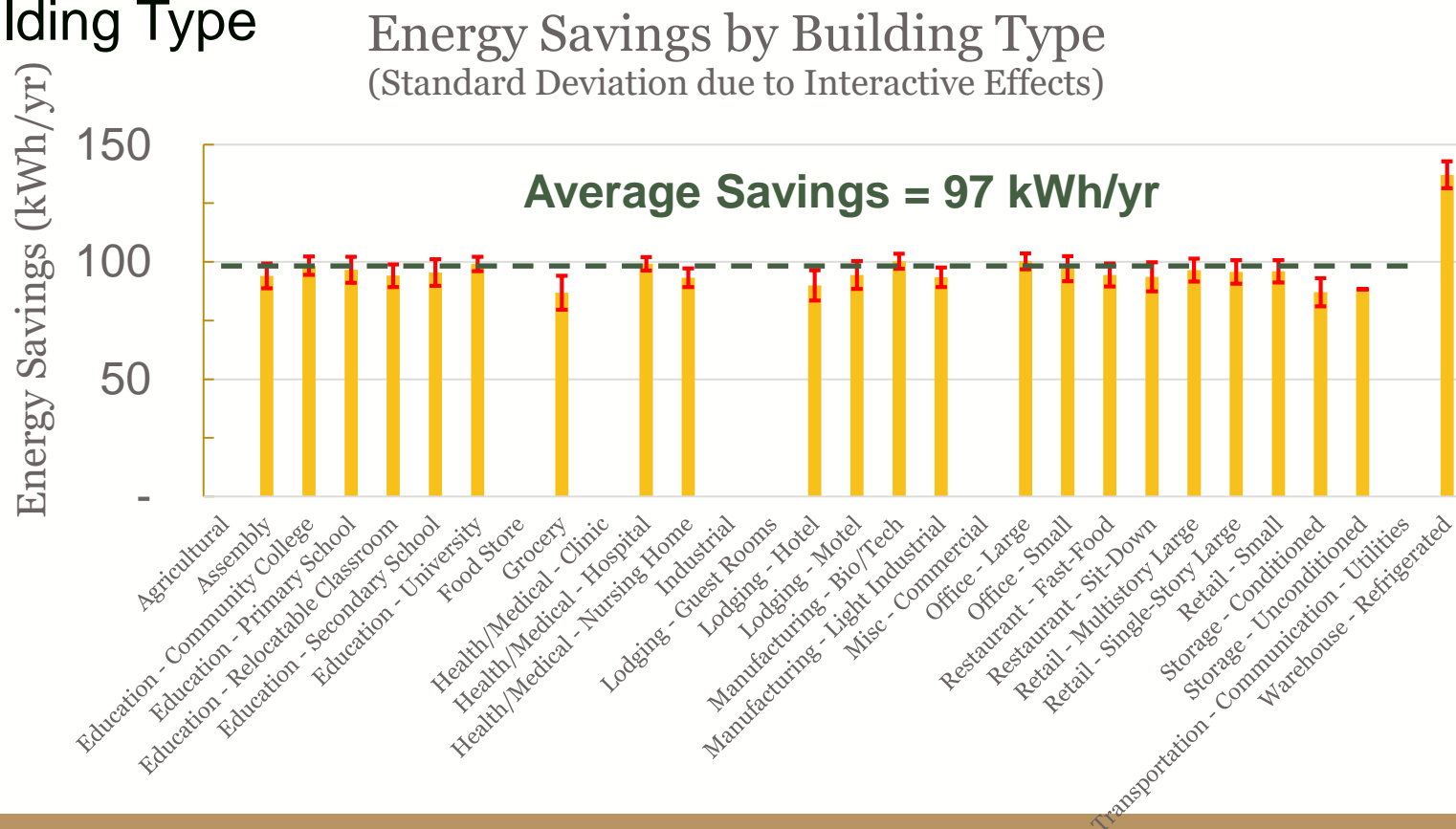
- ❑ Approve current workpaper for migration to eTRM
- ❑ Conduct research to update hours-of-use reduction

# Measure Specific Issue

## 7.15 – PC Management Software

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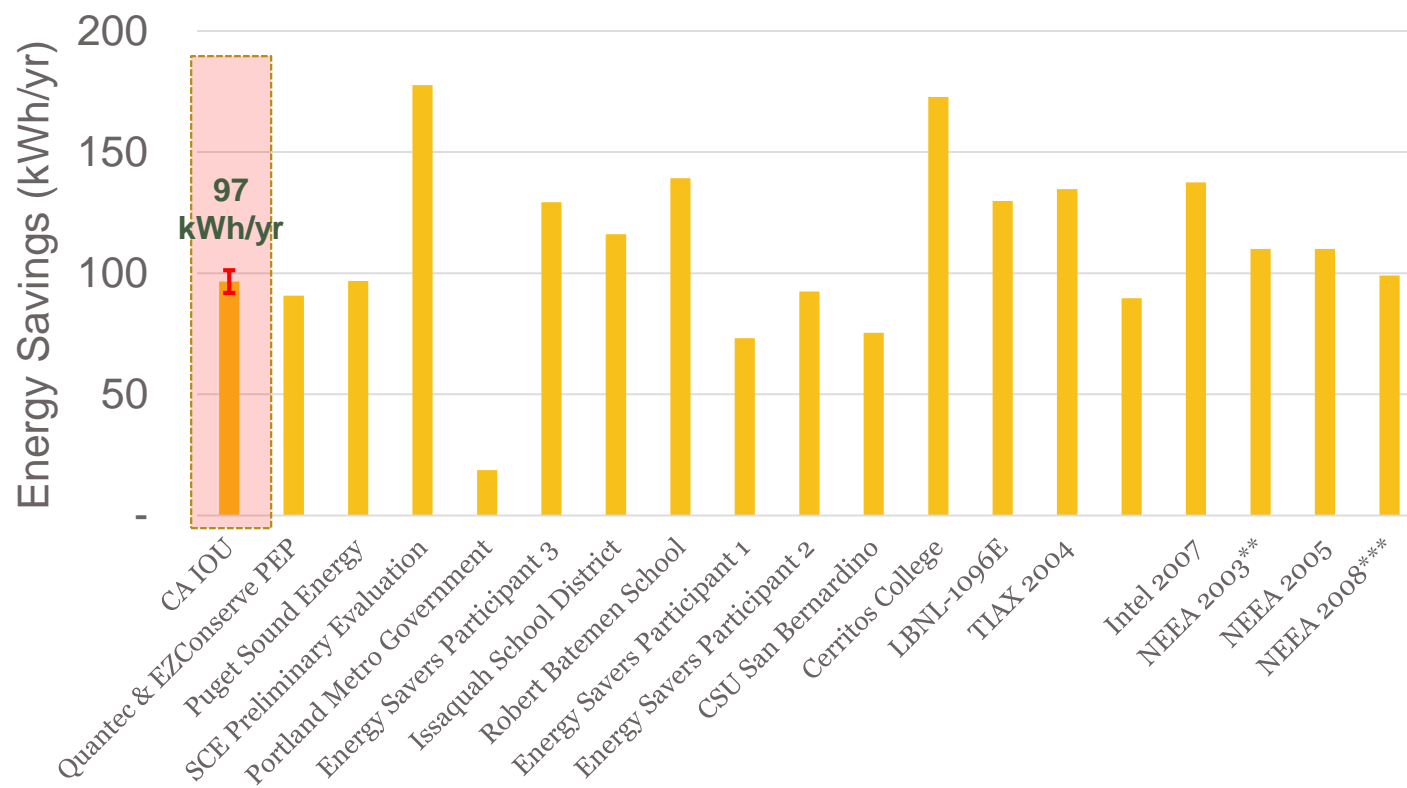
- Examine parameters that affect savings:
  - Climate Zone / Interactive Effects (vary by CZ and PA)
  - Building Type



# Measure Specific Issue

## 7.15 – PC Management Software

### CPM Energy Savings – Source Data



# 7.15 – PC Management Software

- Includes an annual reduction factor in savings.
  - Evaluator recommends one of several paths forward:
    - 1) Continue to apply savings degradation factor each year
    - 2) Upgrade UEC value annually
    - 3) Upgrade UEC every two or three years, and apply degradation during non-update years
  - Expectation is that UEC will continue to decrease
    - ✦ LCD monitors -> LED monitors -> OLED monitors
    - ✦ Newer Operating Systems have much better standby/sleep mode recovery
    - ✦ One offsetting item is increasing use of multi-monitor workstations

# 7.15 – PC Management Software

- Proposal:
- Migrate to eTRM
  - Include degradation factor for now
    - UEC update would be beneficial, but will take time and money
  - Collapse interactive effects
    - Impact variations by climate zone are minimal
    - Should be minimal since savings mostly occurs during building unoccupied times
    - Analysis suggests it is statistically insignificant in any event

## 7.09 – Ozone Laundry - Commercial

- ❑ PG&E Work Paper
- ❑ Technology uses Ozone ( $O_3$ ) injection into wash water to reduce detergent and hot water needs
- ❑ Measure limited to nursing homes, correctional facilities, large hotels/motels and fitness centers. Tunnel washers not eligible for measure.
- ❑ Hot water reduction determined from prior projects.
  - ✦ 86% reduction in hot water usage
  - ✦ 39.3 therm savings annually per pound of laundry capacity
- ❑ Electric impacts not quantified in workpaper
  - ✦ Reduced hot water pumping requirement
  - ✦ Reduced washer cycle time
  - ✦ Decreased dryer requirement
  - ✦ Ozone generator increases electric energy required

## 7.09 – Ozone Laundry - Commercial

- ❑ Researched Ozone Laundry in other TRMs
  - ✦ Exists in Illinois TRM v6.0
  - ✦ Gas savings similar to PG&E workpaper
    - 81% hot water reduction in IL-TRM
    - 86% hot water reduction in PG&E work paper
    - Both based on existing projects in respective states
  - ✦ IL TRM quantifies electric impacts
    - 25% reduction in water per load (hot and cold)
    - 2.93 kWh pump savings per pound of laundry capacity (kWh/lb-cap)
    - Washer savings negligible (0.00082 kWh/lb-cap)
    - Ozone Generator electric use negligible (0.0021 kWh/lb-cap)
    - Dryer Load impacts not considered

# 7.09 – Ozone Laundry - Commercial

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## □ Proposal:

- ✦ Migrate PG&E work paper to eTRM
- ✦ Review IL TRM measure for reliability of electric impact determination, and incorporate into measure



# Next Call and Next Steps

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- Follow up on issues from today's call
- Review/update Power Strips (Tier 1 and Tier 2)
- Revisit and close out remaining open measures

- Appendices

# Appendix: Support Data

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## ● Refrigerator TRM Review

State	Uses DOE Test Method	Applies Adjustment to Unit Savings	Comment
Connecticut	Yes	No	
Hawaii	Yes	No	
Maine	Yes	Yes	98.8% factor based on in situ metering versus DOE calculation study
Massachusetts	Yes	No	
Minnesota	Yes	No	
New York	Yes	Yes	If old refrigerator not recycled, applies 80% "Market Effects" factor to savings
Pennsylvania	Yes	No	
Rhode Island	Yes	No	
Texas	Yes	No	
Vermont	Yes	No	
Illinois	Yes	No	

# Appendix: Support Data

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## ● PGE RASS Data – Clothes Dryer

DHW Fuel	NO DRYER	NATURAL GAS DRYER	ELECTRIC DRYER	BOTTLED GAS DRYER	NO RESPONSE	NOT APPLICABLE	Total
Natural Gas	471	1,787	2,572	3*	10*	499	5,342
	8.80%	33.50%	48.10%	0.1%*	0.2%*	9.30%	100%
Electric	15*	10	73			38	136
	11.0%*	7.4%*	53.70%			27.90%	100%
Propane	4*	2*	7*	5*		9*	27
	14.8%*	7.4%*	25.9%*	18.5%*		33.3%*	100%
Solar		1*	1*				2
		50.0%*	50.0%*				100%
Other						2*	2
						100.0%*	100%
Total	490	1,800	2,653	8	10	548	5,509
	8.90%	32.70%	48.20%	0.10%	0.20%	9.90%	100%

# Appendix: Support Data

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- SCE RASS Data – Clothes Dryer

DHW Fuel	NO DRYER	NATURAL GAS DRYER	ELECTRIC DRYER	BOTTLED GAS DRYER	NO RESPONSE	NOT APPLICABLE	Total
Natural Gas	790	5,443	1,615	17*	21*	1,031	8,917
	8.90%	61.00%	18.10%	0.2%*	0.2%*	11.60%	100%
Electric	94	32	497	11*	11*	317	962
	9.80%	3.30%	51.70%	1.1%*	1.1%*	33.00%	100%
Propane	62	5*	138	179		48	432
	14.40%	1.2%*	31.90%	41.40%		11.10%	100%
Solar						1*	1
						100.0%*	100%
Other	1*		1*			6*	8
	12.5%*		12.5%*			75.0%*	100%
Total	947	5,480	2,251	207	32	1,403	10,320
	9.20%	53.10%	21.80%	2.00%	0.30%	13.60%	100%

# Appendix: Support Data

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- SCG RASS Data – Clothes Dryer

DHW Fuel	NO DRYER	NATURAL GAS DRYER	ELECTRIC DRYER	BOTTLED GAS DRYER	NO RESPONSE	NOT APPLICABLE	Total
Natural Gas	861	6,181	1,648	10*	22*	1,025	9,747
	8.80%	63.40%	16.90%	0.1%*	0.2%*	10.50%	100%
Electric	17*	33	58			38	146
	11.6%*	22.60%	39.70%			26.00%	100%
Propane		4*	2*			4*	10
		40.0%*	20.0%*			40.0%*	100%
Solar						1*	1
						100.0%*	100%
Other		1*	1*			5*	7
		14.3%*	14.3%*			71.4%*	100%
Total	878	6,219	1,709	10	22	1,073	9,911
	8.90%	62.70%	17.20%	0.10%	0.20%	10.80%	100%

# Appendix: Support Data

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- SDGE RASS Data – Clothes Dryer

DHW Fuel	NO DRYER	NATURAL GAS DRYER	ELECTRIC DRYER	BOTTLED GAS DRYER	NO RESPONSE	NOT APPLICABLE	Total
Natural Gas	71,366	426,196	200,691	118*	474*	110,385	809,230
	8.80%	52.70%	24.80%	0.0%*	0.1%*	13.60%	100%
Electric	442*	5,877	9,126			7,203*	22,648
	2.0%*	25.9%*	40.30%			31.8%*	100%
Propane			120*	108*		355*	583
			20.6%*	18.5%*		60.9%*	100%
Solar							
Other		108*					108
		100.0%*					100%
Total	71,808	432,181	209,937	226	474	117,942	832,568
	8.60%	51.90%	25.20%	0.00%	0.10%	14.20%	100%

# 7.05 – Energy Star Clothes Washers

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- RASS Summary by IOU

		Gas WH	Electric WH
PG&E	Gas Dryer	40%	0%
SCE		72%	0%
SDG&E		66%	1%
SCG		78%	0%
PG&E	Electric Dryer	58%	2%
SCE		21%	7%
SDG&E		31%	1%
SCG		21%	1%

*Source: Clothes Washers Calculations\_R6.xls (PGE)*



# 7.05 – Energy Star Clothes Washers

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- Workpaper Differences

- MF-CA and Non-Res wash cycles/yr

- ✦ MF-CA = 1,095 per 2015 Technical Support Document (TSD)
    - ✦ Non-Res = 1,497 per 2015 TSD
    - ✦ PGE WP uses these values
    - ✦ SCE WP based on prior TSD

- Differing Electric Savings between IOU

- ✦ Appears to be due to Dryer and Water Heating share differences
      - Efficient washer wrings out more moisture from clothes, reducing dryer requirements
      - PGE has largest overall percent of electric dryers

## 7.12 – Energy Star Dishwasher

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- DOE Dishwasher Standard assumes electric water heating
  - ✦ Nearly half of energy usage in test method is for water heating
  - ✦ Most efficiency gains above code arise from reducing hot water use
    - Reduce sump volume in dish machine tub
    - Improve water filtration within dishwasher
    - Optimize spray arm and nozzle configuration
    - Incorporate heater into base of tub
  - ✦ Generally these will increase the amount of energy used by the machine itself
  - ✦ Other actions could reduce machine use
    - Increase insulation of machine to retain more heat
    - Use Permanent Magnet Motor for impeller drive
    - Improved and more sophisticated controls

# 7.12 – Energy Star Dishwasher

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- ❑ ENERGY STAR calculator assumes reduction in machine energy use
  - ✦ 0.42 kWh/cycle versus 0.45 kWh/cycle for DOE compliant
- ❑ ENERGY STAR qualified list 80 standard-size models with positive machine energy savings
  - ✦ 43 models meet ENERGY STAR Most Efficient criteria
- ❑ ENERGY STAR Most Efficient list contains 53 models
  - ✦ 10 models have negative machine savings
  - ✦ 37 models that do not meet Most Efficient criteria show positive machine savings
- Proposal
  - ❑ Migrate from DEER to eTRM
  - ❑ Parse out machine savings from total savings
  - ❑ Consider working with CEE to establish a Tier 2 standard

# Appendix: Support Data

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- Standard-size Dishwasher Consumption

Level	Energy Use (kWh/yr)	Water Use (gal/cyc)	Standby Power (W)	Per Cycle Energy Use Component		
				Total (kWh/cyc)	Water Heating (kWh/cyc)	Machine + Drying (kWh/cyc)
Baseline	307	5.00	0.0	1.43	0.82	0.61
1	295	4.25	0.5	1.35	0.70	0.65
2	280	3.50	0.5	1.28	0.58	0.70
3	234	3.10	0.5	1.07	0.51	0.56
4	180	2.22	0.5	0.82	0.37	0.45
TSD inputs						
Cycles per Year		215				
Standby Hours		8,551	hr/yr			
Csp(water)		0.0024	kWh/gal-F			
T(rise)		70	F			
Eff(water heater,elec)		102%	issue with TSD assumption			

*Recreated from Table 7.2.3 of TSD*

# Cross-Cutting Issue

## Retail Products Platform (RPP)

- Background:
  - PG&E and SMUD are currently offering RPP.
  - Operates as a “Market Transformation” program, not a “Resource Acquisition” program
  - Net-to-Gross – follows a Bass Diffusion Model
  - Cost – re-calculated annually using hedonic price modeling from a web-harvesting tool that runs periodically throughout the year.
  - Savings – methodology matches the methodologies used for a “Resource Acquisition” program.

# Cross-Cutting Issue

## Retail Products Platform (RPP)

- Background (*continued*):

- Includes:
  - ✦ Freezers
  - ✦ Electric Clothes Dryers
  - ✦ Gas Clothes Dryers
  - ✦ Room Air Cleaners
  - ✦ Soundbars
  - ✦ Room Air Conditioners
- Additional Measures to be added for 2017.
  - ✦ Refrigerators
  - ✦ Clothes Washers
- Proposed Measures for 2018
  - ✦ Dehumidifiers
- General principle is to add two measures annually

# 7.18 – Vending Machine Controller

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- ❑ Add-on control for vending machines and beverage coolers
- ❑ Uses occupancy sensor technology to shut off lighting and reduce compressor operation
  - ✦ Variant uses “sales-based intelligence” to control cooling system operation
- ❑ Current work paper uses 4 hours/day for hours-of-use reduction (per DEER 2004-05)
  - ✦ Corresponds to 16.67% reduction in energy use
  - ✦ Most other TRMs around the country use 46% reduction, which is largely based on one vendor’s claims
  - ✦ Wisconsin Focus on Energy cites three studies in support of the 46% value
    - Texas A&M campus study
    - Michigan Energy Office (case study 05-0042)
    - E-Source review (document ER-00-12)
  - ✦ Has any valid metering study been done in California to update the DEER value?

## 7.18 – Vending Machine Controller

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- ❑ POU TRM relies on same data as other states' TRMs to arrive at much larger savings versus Work Paper
- ❑ Massachusetts TRM notes that measure is not eligible for installation on ENERGY STAR qualified vending machines, as they already have control capability built-in

### Proposal:

- ❑ Approve current workpaper for migration to eTRM
- ❑ Conduct research to update hours-of-use reduction