



Draft Report

# Residential Solutions Workbook Phase II: Measure View

June 10, 2015



Draft Report

# Residential Solutions Workbook Phase II: Measure View

June 10, 2015

Funded By:

Southern California Edison,  
Pacific Gas and Electric Company,  
San Diego Gas and Electric, and  
Southern California Gas Company

Prepared By:

Research Into Action, Inc.  
CALMAC Study ID PGE0359.03

---



[www.researchintoaction.com](http://www.researchintoaction.com)

PO Box 12312  
Portland, OR 97212

3934 NE Martin Luther King Jr. Blvd., Suite 300  
Portland, OR 97212

Phone: 503.287.9136  
Fax: 503.281.7375

Contact:  
Jane S. Peters, President  
[Jane.Peters@researchintoaction.com](mailto:Jane.Peters@researchintoaction.com)

---

# Table of Contents

---

Table of Contents .....	i
List of Tables.....	ii
List of Figures.....	iii
Acknowledgements .....	v
1. Introduction.....	1
1.1. Dashboard Purpose .....	1
1.2. Project Background.....	1
1.3. Next Steps .....	1
2. RSW II Overview .....	2
2.1. Research Approach and Activities.....	2
2.2. Devices and Measures.....	3
2.3. Workbook Structure .....	4
2.3.1. Advanced Power Strips .....	4
2.3.2. Clothes Dryers .....	9
2.3.3. Pool Pumps .....	13
2.3.4. Air Cleaners .....	16
2.3.5. Water Heaters.....	19
2.4. Market Indicators .....	26
2.4.1. Advanced Power Strips .....	26
2.4.2. Clothes Dryers .....	28
2.4.3. Pool Pumps .....	33
2.4.4. Air Cleaners .....	36
2.4.5. Water Heaters.....	38
2.5. Sources.....	40
2.5.1. Advanced Power Strips .....	40
2.5.2. Clothes Dryers .....	43
2.5.3. Pool Pumps .....	45
2.5.4. Air Cleaners .....	47
2.5.5. Water Heaters.....	49
3. Next Steps .....	53

## List of Tables

Table 2-1: Device and Measure List.....	3
Table 2-2: Overview of Market Indicators Collected for Each Device .....	26
Table 2-3: RSW Market Indicator Details: Device Barriers and Opportunities .....	26
Table 2-4: RSW Market Indicator Details: Energy Savings.....	27
Table 2-5: RSW Market Indicator Details: Measure Applications.....	27
Table 2-6: RSW Market Indicator Details: Measure Features, Trends, and Limitations .....	27
Table 2-7: RSW Market Indicator Details: Existing Program Information .....	27
Table 2-8: RSW Market Indicator Details: Retail Availability and Unit Costs.....	28
Table 2-9: RSW Market Indicator Details: Sizes.....	28
Table 2-10: RSW Market Indicator Details: Efficiency Requirements .....	28
Table 2-11: RSW Market Indicator Details: Number of Models.....	29
Table 2-12: RSW Market Indicator Details: Number of Brands.....	29
Table 2-13: RSW Market Indicator Details: Retail Online Availability.....	29
Table 2-14: RSW Market Indicator Details: Average Models Available Online per Store .....	29
Table 2-15: RSW Market Indicator Details: Unit Cost .....	30
Table 2-16: RSW Market Indicator Details: Unit Shipments.....	30
Table 2-17: RSW Market Indicator Details: Penetration of Sizes .....	30
Table 2-18: RSW Market Indicator Details: Market Penetration.....	30
Table 2-19: RSW Market Indicator Details: Energy Use .....	31
Table 2-20: RSW Market Indicator Details: Unit Energy Savings .....	31
Table 2-21: RSW Market Indicator Details: Programs Incenting Measure .....	31
Table 2-22: RSW Market Indicator Details: Non-Energy Benefits.....	32
Table 2-23: RSW Market Indicator Details: Barriers to Adoption .....	32
Table 2-24: RSW Market Indicator Details: Technology Trends .....	32
Table 2-25: RSW Market Indicator Details: Key Trends .....	32
Table 2-26: RSW Market Indicator Details: Availability.....	33

Table 2-27: RSW Market Indicator Details: Program Eligible Models .....	33
Table 2-28: RSW Market Indicator Details: Costs .....	33
Table 2-29: RSW Market Indicator Details: Penetration and Shipments .....	34
Table 2-30: RSW Market Indicator Details: Energy Savings and Sources of Uncertainty .....	34
Table 2-31: RSW Market Indicator Details: Non-energy Benefits .....	34
Table 2-32: RSW Market Indicator Details: Market and Technology Trends.....	34
Table 2-33: RSW Market Indicator Details: Barriers to Adoption .....	35
Table 2-34: RSW Market Indicator Details: Major Programs Targeting Measure .....	35
Table 2-35: RSW Market Indicator Details: Market Actors.....	35
Table 2-36: RSW Market Indicator Details: Codes and Specifications.....	36
Table 2-37: RSW Market Indicator Details: Retail Availability .....	36
Table 2-38: RSW Market Indicator Details: Costs .....	36
Table 2-39: RSW Market Indicator Details: Device Barriers .....	37
Table 2-40: RSW Market Indicator Details: Energy Savings.....	37
Table 2-41: RSW Market Indicator Details: Penetration and Shipments .....	37
Table 2-42: RSW Market Indicator Details: Existing Program Information .....	38
Table 2-43: RSW Market Indicator Details: Work Paper Parameters.....	38
Table 2-44: RSW Market Indicator Details: Retail Availability and Assortment .....	38
Table 2-45: RSW Market Indicator Details: Household Penetration.....	38
Table 2-46: RSW Market Indicator Details: Shipments.....	39
Table 2-47: RSW Market Indicator Details: Costs .....	39
Table 2-48: RSW Market Indicator Details: Energy Savings.....	39
Table 2-49: RSW Market Indicator Details: Codes and Specifications.....	39
Table 3-1: RSW Phase II: Potential Additional Data .....	53

## List of Figures

Figure 2-1: Advanced Power Strips Summary View Tab Snapshot .....	5
Figure 2-2: Advanced Power Strips Additional Research Tab Snapshot .....	6

Figure 2-3: Advanced Power Strips Market Data Tab Snapshot..... 7

Figure 2-4: Advanced Power Strips Measure Features and Trends Tab Snapshot ..... 7

Figure 2-5: Advanced Power Strips Device Barriers and Opportunities Tab Snapshot..... 8

Figure 2-6: Advanced Power Strips Program Data Tab Snapshot..... 9

Figure 2-7: Clothes Dryer Summary Tab Snapshot.....10

Figure 2-8: Clothes Dryer Measure Quantitative Data Tab Snapshot.....11

Figure 2-9: Clothes Dryer Measure Qualitative Data Tab Snapshot.....12

Figure 2-10: Clothes Dryer Codes and Specs Data Tab Snapshot.....13

Figure 2-11: Pool Pump Summary Tab Snapshot .....14

Figure 2-12: Pool Pump Measure Quantitative Data Tab Snapshot .....15

Figure 2-13: Pool Pump Measure Qualitative Data Tab Snapshot.....15

Figure 2-14: Pool Pump Codes and Specs Data Tab Snapshot .....16

Figure 2-15: Air Cleaner Summary Tab Snapshot.....17

Figure 2-16: Air Cleaner Measure Quantitative Data Tab Snapshot.....18

Figure 2-17: Air Cleaner Measure Qualitative Data Tab Snapshot .....19

Figure 2-18: Air Cleaner Codes and Specs Data Tab Snapshot.....19

Figure 2-19: Water Heater Summary Tab Snapshot.....21

Figure 2-20: Water Heater Additional Research Tab Snapshot .....22

Figure 2-21: Water Heater Program Data Tab Snapshot.....23

Figure 2-22: Water Heater Measure Data Tab Snapshot .....24

Figure 2-23: Water Heater Codes and Specs Data Tab Snapshot .....25

Figure 2-24: Water Heater Measure Description Tab Snapshot .....25



## Acknowledgements

---

Thanks are due to the several people and firms who contributed to the development of the Residential Solutions Workbook. They include the utility project manager, Andy Fessel (Pacific Gas and Electric Company), the Pacific Gas and Electric Company project management team of David Bates, Julie Colvin, Jia Huang, and Oriana Tiell for their guidance and input in designing these workbooks. Furthermore, the team would like to thank Amanda Stevens (Southern California Edison) and the many other statewide Plug Load and Appliances team staff who provided input on the workbooks. Finally, thank you to ENERGY STAR<sup>®</sup> for sharing recent research and energy savings data.

# 1. Introduction

---

This report documents the development of the phase II Residential Solutions Workbook (RSW). The RSW II is a set of workbooks that aggregates and displays energy and market data at the measure level for four plug load devices. Data in the RSW II were drawn from evaluations, engineering studies, market characterization reports, and other market data. The four RSW II Version 1.0 tools were released in July, 2015 and are available at <http://www.calmac.org>.

## 1.1. Dashboard Purpose

The RSW II is a set of tools to support residential energy efficiency program planning. The RSW data is intended to provide a single quick reference or starting point to present measure-level and device-level data about a single product, allowing users to prioritize opportunities and identify gaps in available data. The RSW II is not intended to serve as a business or market planning tool, nor is it intended to directly support forecasting or reporting.

## 1.2. Project Background

The RSW II is the second phase in the RSW project, managed by Pacific Gas and Electric Company (PG&E) on behalf of the California investor-owned utilities (IOUs). The RSW I was initiated in 2013 by the IOUs and completed in July 2014. Both the RSW I and RSW II were conceived as a set of MS Excel workbooks that would aggregate data for plug load devices, modeled on the Lighting Solutions Workbook (LSW), a similar project that was first completed in January 2012. The RSW II also builds upon a previous Water Heater dashboard project initiated by the PG&E team and Research Into Action. Through the RSW II project, the draft PG&E water heater workbook was updated and expanded to apply to all the California IOUs.

## 1.3. Next Steps

The RSW II Versions 1.0 provide the most up-to-date data available at the time of completion. To inform planning, the team recommends updating these data every two years, at a minimum. As part of the product-specific research, the project team has identified a number of potential additions to these workbooks, which are noted in the Next Steps chapter.

## 2. RSW II Overview

---

### 2.1. Research Approach and Activities

The project team developed the RSW II as a MS Excel workbook with a summary interface. The RSW was developed through close collaboration between Research Into Action and the California PLA team, led by PG&E. The process of designing the RSW II included:

- › **Identifying devices and market indicators.** The California PLA team identified a list of four high priority devices to include in the RSW II project, and subsequently added water heaters, for which the project team had begun a workbook for PG&E in 2012. The project team developed a list of market indicators based on an assessment of key product tracking and program planning inputs with publicly available data. These market indicators included both quantitative market data and qualitative device trends. The project team worked with the PLA team to revise and refine this list based on data availability and the inputs that are most important to characterizing and tracking product markets. While the list of market indicators are as similar as possible across the five device workbooks, some differences are included based on product characteristics and data availability.
- › **Assessing user requirements for the workbook.** The project team adapted the design of the existing water heater workbook to form the design of the RSW II workbooks. Following the RSW I model, this design is intended to provide easy access to key information via the summary tab, and provide more detailed information on supporting tabs.
- › **Building and verifying the Excel workbook.** The project team built the workbook using the sources and market indicators identified above. To ensure data accuracy, a second team member verified all the data collected. The project team kept the five dashboards as parallel as possible, but
- › **Soliciting input from the PLA team.** The PLA team provided input on draft dashboards at multiple stages throughout the workbook development process.
- › **Presenting the workbooks.** The project team presented the draft final dashboards to make the PLA team aware of the resource and solicit final comments on their design and contents.

>

## 2.2. Devices and Measures

The RSW II includes a separate workbook for each of five devices identified by the IOUs for this research. Working with the PG&E team, the project team developed a list of measures for each product. Table 2-1 lists the four devices and the measures researched for each.

**Table 2-1: Device and Measure List**

PRODUCT	MEASURES
Advanced Power Strips	<ul style="list-style-type: none"> <li>Tier 1 - Timer</li> <li>Tier 1 - Remote Switch</li> <li>Tier 1 - Master-Controlled</li> <li>Tier 1 - Masterless</li> <li>Tier 2 - Motion Sensing</li> <li>Tier 2 - IR Sensing</li> </ul>
Clothes Dryers	<ul style="list-style-type: none"> <li>Standard Electric</li> <li>ENERGY STAR® - Standard Electric</li> <li>ENERGY STAR 2014 Emerging Technology Heat Pump Hybrid Heat Pump (International)</li> <li>Compact Electric (120V)</li> <li>Compact Electric (240V)</li> <li>Vented Compact Electric (240V)</li> <li>ENERGY STAR - Compact Vented Electric</li> <li>ENERGY STAR - Compact Ventless Electric (240V)</li> <li>ENERGY STAR - Compact Ventless Electric (120V)</li> <li>Vented Gas</li> <li>ENERGY STAR - Standard Gas</li> </ul>
Pool Pumps	<ul style="list-style-type: none"> <li>Dual-Speed</li> <li>Variable-Speed</li> <li>Consortium for Energy Efficiency (CEE) Tier 1</li> <li>CEE Tier 2</li> </ul>
Air Cleaners	<ul style="list-style-type: none"> <li>Air Cleaner</li> <li>ENERGY STAR Air Cleaner</li> </ul>
Water Heaters	<ul style="list-style-type: none"> <li>Electric Federal Baseline</li> <li>Heat Pump</li> <li>Point-of-Use</li> <li>Electric Whole-home Tankless</li> <li>Gas Federal Baseline</li> <li>Gas Storage ENERGY STAR</li> <li>Condensing Storage ENERGY STAR</li> <li>Condensing Tankless</li> </ul>

PRODUCT	MEASURES
	Gas Whole-home Tankless
	Gas Whole-home Tankless ENERGY STAR
	Gas Hybrid
	Solar

## 2.3. Workbook Structure

Each device workbook contains summary tabs, qualitative data tabs, quantitative data tabs, and source information tabs:

- › **Summary view tabs:** Compact visual displays of market data and a summary of qualitative data associated with each measure. The summary tabs are the user’s primary entry point to each RSW.
- › **Quantitative data tabs:** All quantitative data displayed in the workbook including energy savings, retail availability, measure cost, and market penetration. The header rows in this tab include the market indicator description, territory (national, state, or IOU territory), year, and source number. These numbered sources appear on the source information tab. The quantitative data tabs may be useful to users seeking to export data from each RSW.
- › **Qualitative data tabs:** All qualitative data displayed in the workbook including measure descriptions, energy savings sources of uncertainty, barriers, and program opportunities. The header rows in this tab include the market indicator description, territory (national, state, or IOU territory), year, and source number. These numbered sources appear on the source information tab.
- › **Source information tabs:** A complete list of the sources for each data point in the workbook. Source numbers are used consistently within each workbook.

As appropriate, most workbooks have one tab for quantitative data and another for qualitative data; where there was too much qualitative data to show on one tab, some workbooks contain separate tabs organized by market indicator. The following sections provide descriptions of the tabs in each device workbook.

### 2.3.1. Advanced Power Strips

#### 2.3.1.1. Summary View Tab

The summary view tab displays current market data, technology features, barriers, and program opportunities:

- › **Market data:** Provides national and IOU level data for each advanced power strip (APS) measure including retailer availability, unit energy savings, technical potential, market

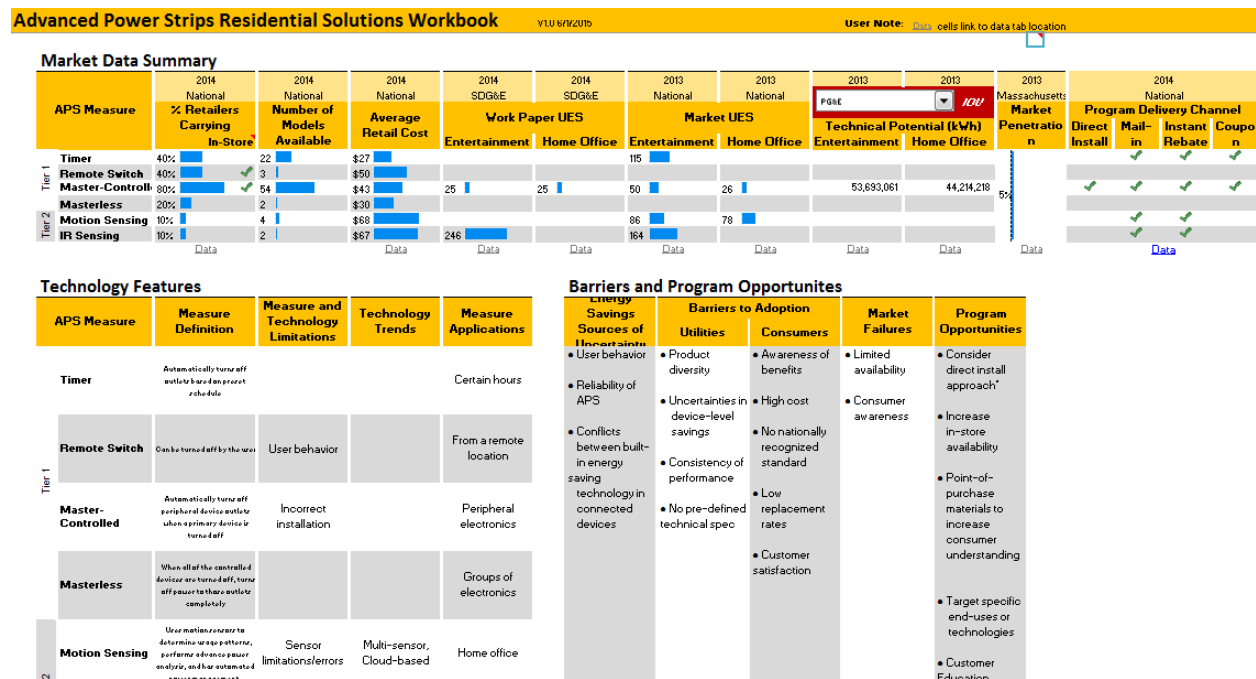
penetration, and program delivery channel. A dropdown allows users to select an IOU to display relative technical potential (kWh) in the IOUs' service territories by end use.

- › **Technology features:** Provides the definition for each measure as well as a summary of technology limitations, technology trends, and applications for each measure.
- › **Barriers and program opportunities:** Provides a summary of sources uncertainty for energy savings estimates, barriers to adoption, market failures, and program opportunities.

Additionally, the tab provides links to the various market indicators collected and a “read me” with a brief introduction to the workbook. Under each column in the summary view is a data link, which will take the user directly to the relevant source in the workbook.

Figure 2-1 shows a screen shot of the summary view tab.

Figure 2-1: Advanced Power Strips Summary View Tab Snapshot



### 2.3.1.2. Additional Research Tab

The additional research questions tab provides a summary of data collected to address specific questions regarding APS suggested by IOUs through a separate contract, the forthcoming Work Paper Update Project. Information found on this tab includes

- › The number of, penetration, and saturation of TVs in California households, by IOU service territory.
- › Information regarding television replacement rates.

## Residential Solutions Workbook Phase II: Measure View

- › Program information, including program design type, number of programs, measure type, incentive type, and incentive amount.
- › Additional research questions that would require collection of primary source data.

Figure 2-2 shows a screen shot of the additional research tab.

**Figure 2-2: Advanced Power Strips Additional Research Tab Snapshot**

This research has been conducted as part of a related market research project for advanced power strips. This research is in DRAFT form.							
What is the potential market penetration and saturation for APS with TVs in California?							
Number of Televisions in California							
IOU	Source:	2012 CLASS Number homes with TVs	2012 CLASS Penetration	2012 CLASS Saturation	Multiple sources Population	https://www.census.gov/newsroom/average-household-size	
Statewide		32,224,300	0.987		2.47	38,332,521	2.9
PG&E		12,153,103	0.979		2.25	16,000,000	2.9
SCE		32,087,034	0.995		6.68	14,000,000	2.9
SDG&E		2,881,412	0.993		2.55	3,300,000	2.9
Television Replacement Rates							
Findings		Year			Source		
Industry experts estimated a shift in replacement rates from the typical 8 to 10 year replacement cycle for CRT TVs, to a 6 to 8 year cycle for flat-panel televisions. Largely driven by increasing screen sizes.		2013			<a href="http://www.corning.com/news_center/features/TV_replacement_c">http://www.corning.com/news_center/features/TV_replacement_c</a>		
In national surveys over the past ten years, about 20% of U.S. households have reported purchasing a new TV set each year.		2014			<a href="http://www.leichtmanresearch.com/research/notes03_2014.pdf">http://www.leichtmanresearch.com/research/notes03_2014.pdf</a>		
The average age of TVs in households that plan to replace their TVs in the next 12 months is 6.1 years.		2012			<a href="http://www.display-central.com/free-news/display-daily/bring-out-your-dead">http://www.display-central.com/free-news/display-daily/bring-out-your-dead</a>		
Program Information							
Source: E Source, 2013							
Of the 35 programs identified there are 5 program design typ							
Program design	Number of Programs	Measure Types	Incentive Type	Incentive amount	Evaluated Savings		
Whole-house or walk-through audits	13	Master-controlled	Direct Install	Free	Unknown		
Product rebates	9	Master-controlled and Timer	Mail-in rebate	\$5.00 - \$10.00	Unknown		
Online store	7	Master-controlled and occupancy se	Instant rebate, mail-in rebate	\$10 - \$20.72; 20% discount	Unknown		
Retail program	5	Master-controlled and Timer	Instant rebate, Coupon	\$4.00 - \$20.00	16.9 kWh/yr (Gross); 57 to 75.04 kWh		
New homes beyond code	1	Master-controlled	Instant rebate	Up to \$14.00	Unknown		
Findings:							
Tier 2 APS are only incented through online stores; no direct-install programs for Tier 2 APS could be found							
Direct install programs are the most common program type, followed by product rebates.							
Currently, there is no publicly available evaluated energy savings associated with Tier 2 APS.							
Programmatic Considerations							
Direct Install may be a very expensive proposition for Plug Load and Appliance program, but IOUs already have other DI programs (like income qualified ESA) where APSs are already installed. Tier 2 may be viable for this program too, though there could be concerns about the satisfaction with device.							
Additional Research Questions							
Question		Potential Source(s)					
What is the market penetration of Tier 2 APS?		Interviews with manufacturers (Tricklestar, WattStopper, Embertec) regarding sales of Tier 2 APSs					
What are the customer benefits and barriers to various delivery models?		Interviews with program implementers associated identified in "program data" tab					
What is the best delivery model for APS, accounting for both validation of correct customer installation and maximizing sales volume?		Interviews with program implementers associated identified in "program data" tab					
Should the IOUs focus on direct install or focus on getting retailers to stock these tier 2 products?		Interviews with program implementers associated identified in "program data" tab					

### 2.3.1.3. Measure Market Data Tab

The measure market data includes the three quantitative market indicators for each measure:

- › **Retail availability:** National data collected from retailer websites visits. Retailers were selected based on top 10 retailers (by 2014 sales) and top 10 consumer electronics retailers (2014 sales). Data includes the number of brands, number of models, and availability of each measure at retailers.
- › **Unit cost:** Cost data collected during retailer website visits as well as measure cost, direct installation cost, total installed cost, and incremental cost from additional sources.
- › **Unit energy savings:** National and regional data, including the most recent unit energy consumption (UEC), range of UEC, baseline UEC, and unit energy savings (UES) range,

by end use. Additionally, savings data from IOU workpapers and technical potential savings by IOU and end use are included.

Figure 2-3 shows a screen shot of the market data tab.

Figure 2-3: Advanced Power Strips Market Data Tab Snapshot

		2014	2014	2014	2014	2014	2014	2014	2014	2014	
Territory		National	National	National	National	National	National	National	National	National	
Source #		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	
Notes		Data collected from retailer websites. Retailers selected bar									
Tier	Measure	# of brands	# of models	Measure is Available Onlin	Measure is Available In-Stu	% of Retailers That Carry 1+	Amazon	Apple	Best Buy	CDW	Costco
1	Timer Power Strip	14	22	Yes	No	40%	Yes	No	No	Yes	No
1	Remote Switch Power Strip	6	3	Yes	Yes	40%	Yes	Yes	No	Yes	No
1	Master-Controlled Power Strip	18	54	Yes	Yes	80%	Yes	No	Yes	Yes	No
1	Masterless Power Strip	2	2	Yes	No	20%	Yes	No	No	No	No
2	Occupancy Sensor Smart Power Strip - Motion Sensing	3	4	Yes	No	10%	Yes	No	No	No	No
2	Occupancy Sensor Smart Power Strip- IR Sensing	2	2	Yes	No	10%	Yes	No	No	No	No

### 2.3.1.4. Measure Features and Trends Tab

The measure features and trends tab includes measure-level qualitative information on measure definitions, measure uses and limitations, technology trends, and top APS models currently on the market, by measure.

Figure 2-4 shows a screen shot of the measure features and trends tab.

Figure 2-4: Advanced Power Strips Measure Features and Trends Tab Snapshot

Measure		Measure Definitions		Uses and Limitations	
Source #		6, 7, 11	6, 7, 11	2	13
Tier	Measure	Measure Description	Other Terminology	Measure applications (location/circumstances of use)	Limitations
1	Timer Power Strip	Power strip automatically turns off outlets based on preset schedule	Timer-controlled	On loads that only need to be powered on during certain hours	None
1	Remote Switch Power Strip	Power strip can be turned off by the user via a remote switch	Infrared (IR) remote	In spaces where loads only need to be used when people are present	Users must be highly motivated and remember to use the remote to turn off the strip.
1	Master-Controlled Power Strip	When a primary device (such as a computer or TV) is turned off by the user, the power strip automatically turns off the controlled outlets where the peripheral devices (such as the printer or game console) are plugged in	USB Power Sensing, Tier 1	Where it is desirable to control loads from a remote location	If the threshold of the control device is set incorrectly, the smart plug strip will not detect the reduced current, and peripherals will not turn off.
2	Masterless Power Strip	When all of the controlled devices are turned off, this type of power strip turns off power to those outlets completely, eliminating all of the vampire loads	None	In spaces where groups of electronics are typically powered on and utilized at the same time.	Unknown
2	Occupancy Sensor Smart Power Strip - Motion Sensing	Power strip looks for signs of activity in the room to determine consumer utilization and usage patterns. If movement is not detected attached devices are turned off.  Performs advanced power analysis in addition to voltage and current sensing. This may include true RMS power, power factor analysis, and other load signature detection. Also has control algorithms to perform automated power management of connected devices based on data and information acquired.	Tier 2, Advanced plug load management devices (APMDs)	Home office	Occupancy sensors on smart plug strips can be improperly adjusted, or fooled into perceiving the presence of the user when a space is unoccupied. Range of sensors is sometimes limited.
2	Occupancy Sensor Smart Power Strip- IR Sensing	Power strip looks for signs of user activity (remote control use) in the room, to determine consumer utilization and usage patterns. If movement is not detected attached devices are turned off.  Performs advanced power analysis in addition to voltage and current sensing. This may include true RMS power, power factor analysis, and other load signature detection. Also has control algorithms to perform automated power management of connected devices based on data and information acquired.	Tier 2, Advanced plug load management devices (APMDs)	Home entertainment	Occupancy sensors on smart plug strips can be improperly adjusted, or fooled into perceiving the presence of the user when a space is unoccupied. Range of sensors is sometimes limited.



### 2.3.1.5. Device Barriers and Opportunities Tab

The device barriers and opportunities tab provides qualitative information on energy savings sources of uncertainty, barriers to adoption, consumer survey information, market penetration, market failures, market actors, and program opportunities. For this tab, information is provided at the device level rather than by individual measures.

Figure 2-5 shows a screen shot of the device barriers and opportunities tab.

Figure 2-5: Advanced Power Strips Device Barriers and Opportunities Tab Snapshot

Source:	8, 11, 12, 16	3, 15	3	14, 8	14	14	13	1, 2, 3	14
Across all Measures	<b>Energy savings sources of uncertainty</b>	<b>Barriers to Adoption - Utilities</b>	<b>Barriers to Adoption - Consumers</b>	<b>Consumer Awareness</b>	<b>Consumer Behavior</b>	<b>Market penetration</b>	<b>Market failures</b>	<b>Market actors</b>	<b>Program Opportunities</b>
	The savings resulting from using an APS will be dependent upon the product in the master control outlet, typically a television for entertainment configurations and a computer for home office configurations. The actual savings achieved will depend heavily on how people use them, as APS products inherently affect the operation of the devices they control. For example, a user may find it beneficial that his game console powers off along with the TV; however, that same user may be inconvenienced if he must first turn on the TV in order to listen to his stereo receiver. Power-use profiles of the end-use appliances affect how effective an APS is at maximizing savings and how much it	<b>Product diversity</b> - This diversity makes it more difficult to determine the performance of individual APMDs and classify them in a standardized way. Also, confusion between Tier 1 and Tier 2 devices.  <b>Uncertainties in device-level savings</b> - Utilities have been hesitant to add APMDs to their energy efficiency programs because there are limited data on factors that affect energy savings and cost-effectiveness calculations, such as device-level savings and resistance.  <b>Consistency of Performance</b> - Some utilities and regulators also want to be sure that incentivized APMDs of similar type from different manufacturers offer similar savings,	Consumers are not aware of the benefits of smart products. The higher cost of smart products may deter adoption. There is no nationally recognized standard for this device. Consider exploring the applicability direct install approach through manufacturers. In exploring a direct install approach, the program administrators should bear in mind that there may be additional cost associated with this type of approach that could jeopardize the cost effectiveness of this measure. Anecdotal evidence suggests power strips and surge protectors are not replaced as	36% aware of APS (unaided) 54% aware of APS (aided) 11% of respondents could either name the intended purpose of APS or describe the color coding that facilities accurate use 38% understood that a APS saves energy, but did not know how Response to question: "How Familiar are you with advanced power strips?" 42% - "Never heard of them" 30% - "Heard of them but know little about them" 22% - "Pretty familiar with them" 5% - "Know all about them"	Percent of home office devices where power management was enabled: 56% - Desktop PC 65% - Laptop 58% - Monitor	29% of households surveyed had a single power strip, 35% had two power strips, and 24% has three or more power strips. 12% had 0. 95% of power strips found in households were standard power strips, with the remaining 5% being smart strips.	2007 study found small stock nationally, on the order of hundred of thousands nationally. Lack of consumer awareness. In commercial settings: lack of clarity on which departments or staff members are responsible for purchasing and installing smart plug strips.	<b>Two main market actors:</b> 1) Manufacturers: Currently there are about 13 APS manufacturers, with Belkin being the number one manufacturer (in 2008 sales). 2) Retailers: APSs are available from a variety of retailers, including hardware, electronic, big box retail, and online merchants.  <b>Top 5 U.S. surge protector manufacturers:</b> 1)Belkin 2) Tripp Lite 3) Philips Electronics 4) Monster Cable 5) Prime  <b>Distribution Channels:</b> 1) Retailers 2) Electrical contractors and installers 3) Utilities 4) Energy auditors 5) Community organizations 6) Green energy organizations	Increase in-store availability of APS. Address APSs in marketing materials. Messaging at point of purchase (POP) may help consumers understand exactly what makes APSs superior to standard power strips from an energy efficiency standpoint. Consider exploring the applicability of direct install approach through manufacturers. In exploring a direct install approach, the program administrators should bear in mind that there may be additional cost associated with this type of approach that could jeopardize the cost effectiveness of this measure. Consider warning consumers that APSs are not appropriate for use with mobile PCs.

### 2.3.1.6. Program Data Tab

The program data tab provides detailed information on programs that currently provide incentives for residential APS units. Information provided includes the utility or organization providing the incentive, incented measures, incentive type (i.e., rebates, coupons, or direct install), and the incentive amount.

Figure 2-6 shows a screen shot of the program data tab.

Figure 2-6: Advanced Power Strips Program Data Tab Snapshot

Source:	4, 20	4, 20	4, 20	4, 20	4, 20	4, 20	4, 20	4, 20
Program Information				Measure Type				
Utility or Organization	Location	Program Design	Program Name	Timer Power Strip	Remote Switch Power Strip	Master-Controlled Power Strip	Masterless Power Strip	Occupancy Sensor Smart Power Strip - Motion
Efficiency Vermont	VT	Retail program	Advanced Power Strip Program				1	
Southern Maryland Electric Cooperative	MD	Walk-through energy audits with direct	Quick Home Energy Check-up				1	
Baltimore Gas and Electric	MD	Walk-through energy audits with direct	Quick Home Energy Check-up				1	
Pepco	MD	install	Quick Home Energy Check-up				1	
Delmarva Power	MD	Walk-through energy audits with direct	Quick Home Energy Check-up				1	
Ontario Power Authority	Ontario,	Retail program	SaveONenergy Coupons				1	
Empire District Electric Co.	AR	Product rebates	Small Appliance Rebate Program				1	
City of Palo Alto Utilities	CA	Product rebates	SMART Energy Program				1	
Minnesota Power	MN	Online store	Protection				1	
West Penn Power	PA	install	Walk Through Energy Audit Program				1	
Grid, Unintil, Western Massachusetts	MA, RI	Online store	Advanced Power Strips				1	1
West Penn Power	PA	install	Whole House Audit Program				1	
Commonwealth Edison	IL	Online store	ComEd Online Store				1	1
West Penn Power	PA	Product rebates	Energy-Efficient Products Program				1	
Efficiency Vermont	VT	New homes beyond code	Energy Code Plus				1	
Met-Ed, Penelec, Penn Power	PA	install	Whole House Program				1	
Met-Ed	PA	install	Walk Through Energy Audit Program				1	
Potomac Edison	MD	Product rebates	Energy Efficient Products Program				1	
Met-Ed, Penelec, Penn Power	PA	Product rebates	Energy Efficient Products Program				1	
Cooperative, Public Service of New Hampshire,	NH	Retail program	Energy Star Appliance Rebates				1	
Cooperative, Public Service of New Hampshire,	NH	Online store	NHSaves Online Catalog				1	1
Ameren	IL	Product rebates	Energy-Saving Product Rebates				1	
Ameren	IL	Online store	Energy-Saving Product Rebates				1	1
Con Edison	NY	install	Energy Survey - Residential				1	
PPL Electric Utilities	PA	install	Efficiency Assessment				1	
Edison	OH	Product rebates	Energy Efficient Products Program				1	
Alliant Energy	MN	install	Home Energy Assessment				1	
Dominion Virginia Power	VA	install	Home Energy Check-Up				1	
Lansing Board of Water & Light	MI	Product rebates	Home Energy Rebates				1	
Xcel Energy	MN	Product rebates	Home Performance with Energy Star	1			1	
Efficiency Nova Scotia	NS	Retail program	Product Rebates	1			1	
Con Edison	NY	install	Efficiency				1	

## 2.3.2. Clothes Dryers

### 2.3.2.1. Summary View Tab

The summary tab displays a summary of current market data, barriers and benefits, codes and specs, technology to target, and key trends:

- › **Market data:** Provides a summary of national data for each measure including, retail availability, unit cost, unit energy use, unit energy savings, and whether any programs are currently incenting each measure. A dropdown allows users to select an IOU to display market penetration in the IOUs service territory.
- › **Barriers and benefits:** Provides a summary of non-energy benefits and barriers to adoption for each measure.
- › **Codes and specs:** Provides a graphical visualization of mandatory and voluntary efficiency standards and qualifications from the Department of Energy (DOE) and ENERGY STAR, by measure.
- › **Technology to target and key trends:** Provides a summary of qualitative data regarding suggestions on what clothes dryer technologies to target and key trends.
- › **Household Service Type:** Provides a summary of the proportion of IOU customers that are electric-only customers versus those that also receive gas service (from any provider).

Additionally, the tab provides links to the various market indicators collected and a “read me” section with a brief introduction to the workbook. Under each column in the summary view is a data link, which will take the user directly to the relevant source in the workbook.

Figure 2-7 shows a screen shot of the summary view tab.

Figure 2-7: Clothes Dryer Summary Tab Snapshot

Clothes Dryer Workbook V1.0 User Note: [Data cells link to data tab location](#)

---

**Market Data Summary**

Clothes Dryer Measure	2012	2014	2014	2015	2015	2015	2014	2014
	Market Penetration	Number of Models Available	Cost	Unit Energy Use (kWh)	Unit Energy Use (MBtu)	Unit Energy Savings (kWh)	Unit Energy Savings (MBtu)	Programs Including Measure
<b>Standard</b>								
Standard Electric	27%	151	\$910	750		0		
ENERGY STAR - Standard Electric		24	\$1,090	608		152		
ENERGY STAR - 2014 Award Winner		2	\$1,649	544		217		✓
<b>Compact</b>								
Compact Electric (120V)	0%	0	\$881	N/A		59		
Compact Electric (240V)	0%	3	\$859	N/A		55		
Vented Compact Electric (240V)	0%	3	\$1,033	N/A		82		
ENERGY STAR - Compact Vented Electric	1%	0	N/A	N/A		0		N/A
ENERGY STAR - Compact Ventless Electric (240V)	0%	0	N/A	N/A		0		N/A
ENERGY STAR - Compact Ventless Electric (120V)	0%	0	N/A	N/A		0		N/A
<b>Gas</b>								
Vented Gas	48%	143	\$1,012	956		0		
ENERGY STAR - Standard Gas		8	\$1,106	685		171		✓
<b>Heat Pump*</b>								
Heat Pump	N/A	N/A	\$983	N/A		0		✓

\*Heat Pumps are currently not available in the US. Although current European Heat Pump models may actually be classified as compact electric.      \*\*2007 National Estimate      †kWh for gas includes therms

---

**Barriers and Benefits**

Clothes Dryer Measure	Non-Energy Benefits	Barriers to Adoption
Standard Electric	Short dry time	
ENERGY STAR - Standard Electric	Improved sensors/controls	Cost, consumer awareness, realistic test procedure, product availability
Heat Pump	Lower air temp associated with less wear and tear on clothes, no vent (avoids air loss, allows flexibility in location, no flexibility in location, no	Availability, longer drying times, consumer skepticism, cost, retail/manufacture uncertainty for demand (reluctance to stock)
ENERGY STAR - 2014 Award Winner	Improved sensors/controls, troubleshooting technology	
Compact Electric	Short dry time, saves space	Capacity
ENERGY STAR - Compact Vented Electric	Saves space, improved sensors/controls	
ENERGY STAR- Compact Ventless Electric	Saves space, improved sensors/controls, no vent (avoids air loss, allows flexibility in location, no construction needed for vent placement)	Availability
Vented Gas	Short dry time	
ENERGY STAR - Standard Gas	Improved sensors/controls	Cost, Consumer awareness, realistic test procedure, manufacturers

**Codes and Specs**

Combined Energy Factor Standards and Qualifications

	Standard Vented Electric	Compact Vented Electric (120V)	Compact Vented Electric (240V)	Compact Ventless Electric (240V)	Vented Gas
DOE 1994*	3.04	2.13	2.90	2.90	2.67
DOE 2005 (Current Standards)	3.73	3.61	3.27	2.50	3.30
DOE 2005 (Proposed Baseline Based on updated Test Procedure)**	3.11	3.03	1.90	2.33	2.77
ENERGY STAR 2015**	3.93	3.00	3.45	2.60	3.45

\* Value is actually Energy Factor, not combined energy factor, which does not account for standby mode  
\*\* These standards were calculated using the D2 test procedure versus D1 test procedure

**READ ME**

Designed by: Research Into Action  
This workbook is designed to inform the California Statewide PLA team's Clothes Dryer program planning. The tool aggregates clothes dryer measure market data from a variety of sources. Measures were defined consistent with DOE and ENERGY STAR definitions.  
Intended uses: These data are intended to provide a starting point in program planning; they are not intended to inform forecasting or reporting. The applicable year, territory, and sources have been tracked for each data point collected. Consult these sources for specific questions on data interpretation.

**Tab Overview:**

Summary	Overview of key data points
Measure Quantitative Data	Data table of all quantitative data
Measure Qualitative Data	Data table for all qualitative data
Codes and Specs Data	Past and current specifications
Source Info	Numbered source information

**Technology to Target**

- Hybrid heat pumps
- Higher-efficiency non-condensing vented electric & gas dryers

**Key Trends**

- Awareness: 92% of CA residents know that some clothes dryers are more efficient than others.
- Development of ENERGY STAR Specification.
- Hybrid heat pump dryers are becoming available in the US and represent about

### 2.3.2.2. Measure Quantitative Data Tab

Measure quantitative data includes five market indicators for each measure:

- › **Measure information:** National data regarding size ranges for the dryer drum (in cubic feet) and combined energy factor (CEF), by measure.
- › **Retail availability:** National data collected from ENERGY STAR qualified product lists and retailer website visits, by measure. Data collected includes, the number of models and number of brands available.
- › **Unit cost:** National data collected during retailer website visits, including notes on how unit costs were calculated.

- › **Unit penetration and shipments:** National data for unit shipments and penetration of dryers by fuel and size, as well as regional and IOU level data on penetration of electric and gas dryers.
- › **Unit energy savings:** National data for the most recent UEC, UES, and lifecycle for each measure.

Figure 2-8 shows a screen shot of the measure quantitative data tab.

Figure 2-8: Clothes Dryer Measure Quantitative Data Tab Snapshot

Measure		Year	ENERGY SAVINGS								
		2009	2015	2015	2015	2013	2015	2015	2015	2013	
Territory		California	National	National	National	National	National	National	National	National	
Source #		26	5,7	17	17	25	5,7	17	17	25	
Note			ENERGY STAR (assumes 20% savings)	DOE - interpolated estimates	DOE - interpolated estimates	ECOVA	ENERGY STAR Unit Energy Savings (UES)	DOE - interpolated estimates	DOE - interpolated estimates	ECOVA	
Fuel	Measure	% that have a dryer - ALL IOU	ENERGY STAR UEC (Unit Energy Consumption)	DOE Annual UEC kWh	DOE Annual UEC therms	ECOVA Annual UEC kWh	ENERGY STAR UES kWh	DOE UES (kWh)	DOE UES (therms)	ECOVA UES kWh	UES/UES Note
Electric	1 Vented Electric, Standard (4.4 ft3 or greater capacity)	30%	760	684	0	742	0	0	0		
Electric	2 ENERGY STAR Ventless or vented electric, standard (4.4 cu-ft or greater)		608	651	0	Unknown	152	33	0		
Electric	3 Heat pump clothes dryer	Unknown		577	0	314	Unknown	107	0	428	ECOVA savings ba
Electric	4 ENERGY STAR 2014 Emerging Technology Award Clothes Dryer		544	597	0	Unknown	217	87	0		
Electric	5 Vented Electric, Compact (120V) (less than 4.4 ft3 capacity)	Unknown		305	0	Unknown	59	0	0		Note that for con
Electric	6 ENERGY STAR Ventless or vented electric, compact (240V) (less than 4.4 ft3 capacity)	Unknown		340	0	Unknown	65	0	0		Note that for con
Electric	7 Ventless Electric, Compact (240V) (less than 4.4 ft3 capacity)	Unknown		372	0	Unknown	82	0	0		Note that for con
Electric	8 ENERGY STAR Ventless or vented electric, compact (120V) less than 4.4 cu ft capacity	N/A		289	0	Unknown	N/A	16	0		no qualifying mo
Electric	9 ENERGY STAR Vented electric, compact (240V) less than 4.4 cu-ft capacity	N/A		322	0	Unknown	N/A	18	0		no qualifying mo
Electric	10 ENERGY STAR Ventless electric, compact (240V) less than 4.4 cu-ft capacity	N/A		355.2	0	Unknown	N/A	17	0		no qualifying mo
Gas	11 Vented Gas	40%	856	29.8	24.5	Unknown	0	0	0		
Gas	12 ENERGY STAR Vented Gas		685	28.295	23.28	Unknown	171	2	1.22		for CEF = 3.49, wh

### 2.3.2.3. Measure Qualitative Data Tab

The measure qualitative data tab provides a detailed description of each measure, non-energy benefits and impacts, sources of savings uncertainty, market failures, barriers to consumer adoption, and major programs currently targeting each measure. Additionally, information on market actors, technology trends, and key trends is included.

Figure 2-9 shows a screen shot of the measure qualitative data tab.

Figure 2-9: Clothes Dryer Measure Qualitative Data Tab Snapshot

Meas #	Year Source #	Measure Description	Non-Energy benefits and impacts	Sources of savings uncertainty	Market failures
		2014	2014	2014	2014
		7, 15	5, 16, 22, 25	16, 23, 25	16
1		Vented Electric, Standard (4.4 ft3 or greater capacity) A cabinet-like appliance designed to dry fabrics in a tumble-type drum with forced air circulation. The heat source is electricity and the drum and blower(s) are driven by an electric motor(s). Exhausts the evaporated moisture from the cabinet.	Convenience: Shorter drying times	The current test procedure may not completely capture efficiency potential. The test clothes specified by both the 2005 and the 2011 DOE test procedures consist of thin 50/50 cotton/synthetic, two-dimensional sheets (similar to handkerchiefs). A realistic test procedure that employed a mix of real clothing over a range of operating conditions would increase product differentiation.	
2		ENERGY STAR Ventless or vented electric, standard (4.4 cu-ft or greater) A cabinet-like appliance designed to dry fabrics in a tumble-type drum with forced air circulation. The heat source is electricity and the drum and blower(s) are driven by an electric motor(s). Exhausts the evaporated moisture from the cabinet. May also use a heat pump for drying.	Convenience: sensor drying, steam features	Ventless and heat pump devices may have space conditioning interactive effects. Customer behavior: use of eco modes.	
3		Heat pump clothes dryer Heat Pump technology is designed to regenerate energy during the drying cycle to reduce energy consumption while providing dryer speed and performance flexibility. Uses a refrigeration system to dry and recycle the same air (no heating element). Hybrid heat pump dryers have a heat pump and a traditional heating element.	Does not need to be vented outside. If the dryer is installed in a home's conditioned space, waste heat can be a benefit on cold days. Heat pump dryers have longer drying times. Lower heat associated with less wear and tear on clothes. No		Units have been available in Europe for over a decade but not in US. DOE standards may classify European units as "compact", despite similar capacity, which affects test procedure and savings estimates.
4		ENERGY STAR 2014 Emerging Technology Award Clothes Dryer The vented LG EcoHybrid Dryer features LG TrueSteam™ technology, which uses real steam to reduce wrinkles and odors. The 7.3-cubic-foot capacity dryer is also equipped with Smart Diagnosis™ technology allowing users to troubleshoot issues without a service call.	Convenience: sensor drying, steam features, equipped with Smart Diagnosis™ technology allowing users to troubleshoot issues without a service call. One award winner does not need to be vented outside. If the dryer is installed in a home's conditioned space, waste heat can be a benefit on cold days.		
5		Vented Electric, Compact (120V) (less than 4.4 ft3 capacity) A cabinet-like appliance designed to dry fabrics in a tumble-type drum with forced air circulation. The heat source is electricity and the drum and blower(s) are driven by an electric motor(s). Exhausts the evaporated moisture from the cabinet. With a drum capacity of less than 4.4 cubic	Convenience: Shorter drying times, Saves space, can be plugged into a standard 120V Outlet		
6		Vented Electric, Compact (240V) (less than 4.4 ft3 capacity) A cabinet-like appliance designed to dry fabrics in a tumble-type drum with forced air circulation. The heat source is electricity and the drum and blower(s) are driven by an electric motor(s). Exhausts the evaporated moisture from the cabinet. With a drum capacity of less than 4.4 cubic	Convenience: Shorter drying times, Saves space		
7		Ventless Electric, Compact (240V) (less than 4.4 ft3 capacity) A clothes dryer that uses a closed-loop system with an internal condenser to remove the evaporated moisture from the heated air. Moist air is not discharged from the cabinet.	Convenience: Shorter drying times, Saves space, doesn't require vent (avoids air loss, allows flexibility in location, no construction needed for vent placement)		

### 2.3.2.4. Codes and Specs Data Tab

The codes and specs data tab provides data on past, current, and proposed specifications from ENERGY STAR and DOE. Each specification includes information on the measure requirements and each specification's effective date.

Figure 2-10 shows a screen shot of the codes and specs data tab.

Figure 2-10: Clothes Dryer Codes and Specs Data Tab Snapshot

Specification			
Spec	Requirement	Effective Date	Source ID
ENERGY STAR V1.0	Vented Gas 3.48 Ventless or Vented Electric, Standard (4.4 cu-ft or greater capacity) 3.93 Ventless or Vented Electric, Compact (120V) (less than 4.4 cu-ft capacity) 3.80 Vented Electric, Compact (240V) (less than 4.4 cu-ft capacity) 3.45 Ventless Electric, Compact (240V) (less than 4.4 cu-ft capacity) 2.68 Cycle Time Requirement Maximum Test Cycle Time 80 minutes	Jan-15	1
DOE	Amended Energy Conservation Standards for Vented and Ventless Residential Clothes Dryers Product Class Energy Factor (pounds/kWh) Manufactured or Distributed into Commerce On or After Jan 1, 2015 1. Vented Electric, Standard (4.4 ft3 or greater capacity) 3.73 2. Vented Electric, Compact (120V) (less than 4.4 ft3 capacity) 3.61 3. Vented Electric, Compact (240V) (less than 4.4 ft3 capacity) 3.27 4. Vented Gas 3.30 5. Ventless Electric, Compact (240V) (less than 4.4 ft3 capacity) 2.55 6. Ventless Electric Combination Washer/Dryer 2.08	Jan-15	18
DOE	Product Class Energy Factor (pounds/kWh) Manufactured On or After May 14, 1994: 1. Electric, Standard (4.4 ft3 or greater capacity) 3.01 2. Electric, Compact (120V) (less than 4.4 ft3 capacity) 3.13 3. Electric, Compact (240V) (less than 4.4 ft3 capacity) 2.90 4. Gas 2.67	May-94	18
DOE	Proposed Baseline CEF (Appendix D2) lb/kWh 1. Vented Electric, Standard (4.4 ft3 or greater capacity) 3.11 2. Vented Electric, Compact (120V) (less than 4.4 ft3 capacity) 3.03 3. Vented Electric, Compact (240V) (less than 4.4 ft3 capacity) 1.9 4. Vented Gas 2.77 5. Ventless Electric, Compact (240V) (less than 4.4 ft3 capacity) 2.33 6. Ventless Electric Combination Washer/Dryer 2.00	N/A	37

### 2.3.3. Pool Pumps

#### 2.3.3.1. Summary View Tab

The summary view tab displays a summary of current market data, technology vs. CEE Tier comparison, barriers, codes and specs, and qualitative data regarding the benefits of variable speed pool pumps (VSPs) and remaining research questions:

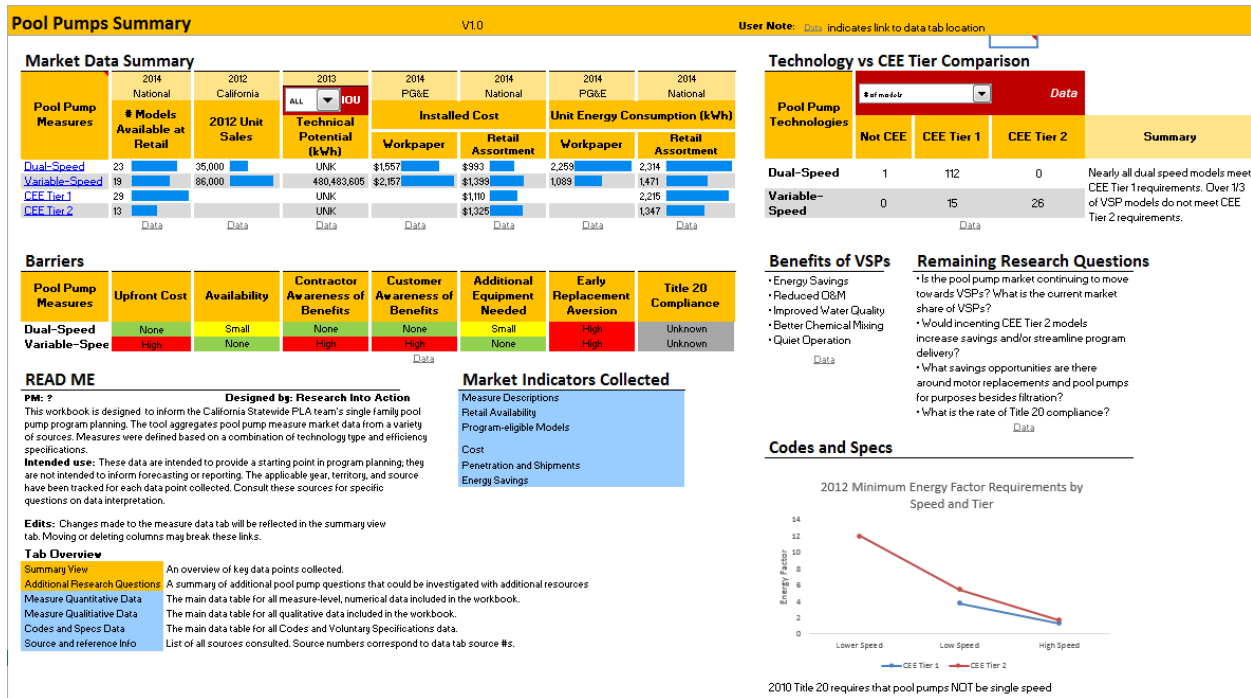
- › **Market data:** Provides national and IOU level data for retail availability, unit sales, installed costs, and UEC, by measure. A dropdown allows users to select an IOU to display technical potential in the IOUs service territory.
- › **Technology vs CEE Tier comparison:** Provides a comparison of dual and variable-speed pool pumps and CEE Tiers. A dropdown allows users to select the desired comparison, including the number of models, cost, or savings associated with each CEE Tier.
- › **Barriers:** Provides a summary of the various barriers identified during data collection for dual and variable-speed pool pumps. Barriers are ranked from “none” or “unknown” to “high” and are color-coded.
- › **Codes and specs:** Provides a graphical visualization of 2012 minimum energy factor requirements by speed and CEE Tier.

- › **Benefits of VSPs and remaining research questions:** Provides a summary of the benefits of VSPs identified during data collection and suggestions for research questions that would require collection of primary source data.

Additionally, the tab provides links to the various market indicators collected and a “read me” with a brief introduction to the workbook. Under each column in the summary view is a data link, which will take the user directly to the relevant source in the workbook.

Figure 2-11 shows a screen shot of the summary view tab.

Figure 2-11: Pool Pump Summary Tab Snapshot



### 2.3.3.2. Measure Quantitative Data Tab

Measure quantitative data includes six market indicators for each measure:

- › **Measure information:** Information on the size of each measure (nameplate horsepower) and the California efficiency requirement.
- › **Retail availability:** National data collected from the Association of Pool and Spa Professionals, retail websites, and the ENERGY STAR qualified product list. Data includes number of brands, number of qualified models, and measure availability for four main pool pump retailers.
- › **Program eligible models:** Data regarding the number of qualifying models for PG&E, Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E).

- › **Unit cost:** National and IOU level data collected from IOU work papers and during retailer website visits, including estimated installation costs.
- › **Unit penetration and shipments:** Data regarding the number of existing pool pumps, number of residential pools, and unit sales in California, by measure.
- › **Unit energy savings:** National and IOU level data for the most recent UEC, UES, and technical potential for each measure.

Figure 2-12 shows a screen shot of the measure quantitative data tab.

Figure 2-12: Pool Pump Measure Quantitative Data Tab Snapshot

Measure	Measure Information		Availability							
	Year	Territory	2012	2014	2014	2014	2014	2014	2014	2014
	California	California	National	National	National	National	National	National	National	National
	Source #	15	15	15	4	14	16	20	4, 14, 16, and 20	
	Note		Last updated on Oct 14, 2014			Data collected from retailer websites.				
Meas	Measure	Size (Nameplate horsepower)	Efficiency requirement/definition	# of brands	# Qualified Models	Leslie's Pool Supply	Pool Supplies.com	BestBuy Pool Supplies	Amazon	Available at Any of Four Retailers
1	Dual-Speed	.17-3hp	Two-speed pumps use a motor capable of running at two defined speeds: a high speed for tasks requiring greater flow, and a low speed for filtration. Two-speed pumps have been available for more than 10 years, but have gained relatively little market acceptance. Two-speed pumps are typically more expensive than single-speed pumps and require a timer capable of controlling both speeds, which further increases the cost.	5	113	2	0	19	4	23
2	Variable-Speed	1-4hp	The ability to operate a pool pump at more than two speeds based on user presets. See "CEE Tier Specs" tab for full definition and specifications that make a pump Tier 1 and Tier 2.	6	41	9	2	13	13	19
3	CEE Tier 1	.17-4hp	CEE Tier 1 pumps must have at least two speeds and a low-speed energy factor of >=3.8 and a high speed energy factor of >=1.6.	6	127	5	1	24	9	28
4	CEE Tier 2	1-4hp	CEE Tier 2 pumps must have at least three speeds and a low-speed energy factor of >=12.0, a medium speed energy factor of >=5.5 and a high speed energy factor of >=1.7.	6	26	6	1	8	8	13

### 2.3.3.3. Measure Qualitative Data Tab

The measure qualitative data tab provides a detailed description of each measure, non-energy benefits and impacts, sources of savings uncertainty, market and technology trends, barriers to adoption, major programs currently targeting each measure, and market actors.

Figure 2-13 shows a screen shot of the measure qualitative data tab.

Figure 2-13: Pool Pump Measure Qualitative Data Tab Snapshot

Year	Source #	Measure Description	Measure applications (location/circumstances of use)	Non-Energy benefits and impacts	Energy savings sources of uncertainty	Market and technology trends	Barriers to adoption
	1						
1	Dual-Speed	Two-speed pumps use a motor capable of running at two defined speeds: a high speed for tasks requiring greater flow, and a low speed for filtration. Two-speed pumps have been available for more than 10 years, but have gained relatively little market acceptance. Two-speed pumps are typically more expensive than single-speed pumps and require a timer capable of controlling both speeds, which further increases the cost.	In-ground pools	None identified	n/a	Retailers and installers appear to be shipping dual speed (and multi-speed) and going straight to VSPs. The major retailer, Leslie's Pool supply, does not offer dual-speed pumps on their national website. They only offer single speed and VSPs.	Need to purchase a controller in addition to pump in many cases, leading to increased cost. Title 20 compliance: In 2012, 60% of installers sold single speed pumps.
2	Variable-Speed	The ability to operate a pool pump at more than two speeds based on user presets. See "CEE Tier Specs" tab for full definition and specifications that make a pump Tier 1 and Tier 2.		Quiet operation, improved water quality, better pool chemical mixing	Range depends on hours of operation and months of use. ESTAR assumes the following: -12 months of use in California -Cycles are -10 hours of low speed operation for cleaning. -2 hours of high speed operation for cleaning.	VSPs appear to be the dominant pool pump offered in California. Single speed pumps appear to be offered by national retailers, but that is not applicable to CA (and FL) where single speed pumps are outlawed.	-First cost; -Lack of contractor understanding of EE benefits; -Lack of end-user understanding of efficiency benefits; -Early replacement aversion: Users replace pumps at failure. -Title 20 compliance: In 2012, 60% of installers sold single speed pumps.
3	CEE Tier 1	The Consortium for Energy Efficient (CEE) categorizes efficient pool pumps in two categories. Tier 1 pumps must have at least two speeds and have a low-speed energy factor of >=3.8 and a high speed energy factor of >=1.6.		Depends on dual-speed or variable speed pump status.	See ESTAR calculator for assumptions	In 2012, 100% of surveyed installers said they have installed VSPs, while 22% said they sold dual speed pumps.	Same as above
4	CEE Tier 2	The Consortium for Energy Efficient (CEE) categorizes efficient pool pumps in two categories. Tier 2 pumps must have at least three speeds and have a low-speed energy factor of >=12.0, a medium speed energy factor of >=5.5 and a high speed energy factor of >=1.7.		Quiet operation, improved water quality, better pool chemical mixing	Range depends on hours of operation and months of use. ESTAR assumes the following: -12 months of use in California -Cycles are -10 hours of low speed operation for cleaning. -2 hours of high speed operation for cleaning.		Same as above



### 2.3.3.4. Codes and Specs Data Tab

The codes and specs data tab provides data current California Title 20 code and CEE Tier specifications.

Figure 2-14 shows a screen shot of the codes and specs data tab.

**Figure 2-14: Pool Pump Codes and Specs Data Tab Snapshot**

Title 20 Code				
	Requirement	Effective Date	Source ID	
Title 20	<p>Prohibits the use of single speed pumps one HP or larger to filter water. This means, all new construction and replacement pool pumps must be dual speed, multi-speed, or variable speed.</p> <p>Text from CEC Title 20: Residential pool pump motors with a pool pump motor capacity of 1HP or greater which are manufactured on or after January 1, 2010, shall have the capability of operating at two or more speeds with a low speed having a rotation rate that is no more than one-half of the motor's maximum rotation rate. The pump motor must be operated with a pump control that shall have the capability of operating the pump at least at two speeds.</p>	1/1/2010	22 (see p. 154)	
CEE Pool Pump Voluntary Specification				
	# Pump Speeds	Low speed energy factor*	Low speed energy factor**	High speed energy factor***
CEE Tier 1	The ability to operate a pool pump at two speeds based on user presets.		>=3.8	>=1.6
CEE Tier 2	The ability to operate a pool pump at more than two speeds based on user presets.	>=12.0	>=5.5	>=1.7
	*Where "lower speed" is the optimal or most efficient speed for the pool pump, likely ranging from 600 to 1200 RPMs			
	**Where "low speed" is either the minimum speed for two speed pumps or half the maximum speed for variable speed pumps, typically 1725 RPM			
	***Where "high speed" is the maximum operating speed of the pump, usually 3450 RPM			

Note: To incent, have to be listed in CEC database. If they're not in the database, it doesn't matter that they're qualified as Tier II.

## 2.3.4. Air Cleaners

### 2.3.4.1. Summary View Tab

The summary view tab displays a summary of current market data, benefits and barriers, efficiency specifications, product assortment cost comparison, and remaining research questions:

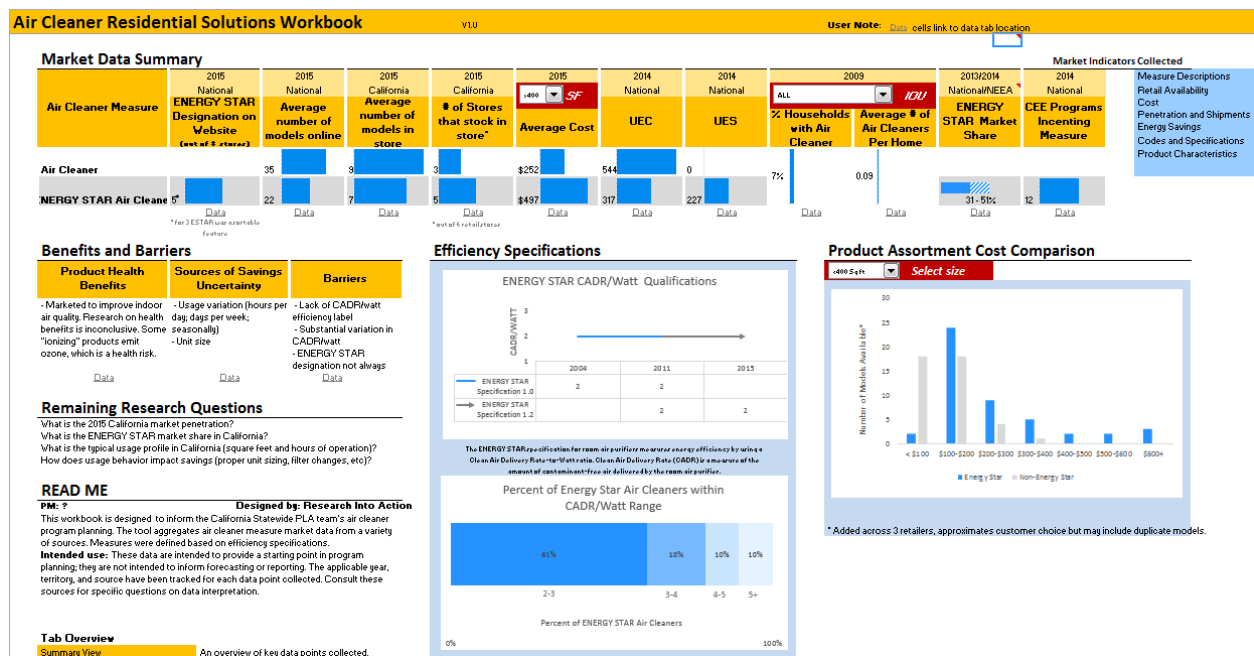
- › **Market data:** Provides national data for each measure including number of models available (ENERGY STAR website, retailer websites, and in store), average cost, unit energy consumption, unit energy savings, penetration, ENERGY STAR market share, and number of programs incenting the measure. A dropdown allows users to select the air cleaner size rating (above or below 400 square feet) to see how ENERGY STAR availability varies at different price points.
- › **Benefits and barriers:** Provides a summary of product health benefits, sources of savings uncertainty, and potential barriers.

- › **Efficiency specifications:** Provides a graphical visualization of ENERGY STAR qualification for clean air delivery rate (CADR) per watt by year and the percent of ENERGY STAR qualified air cleaners within each CADR/watt range.
- › **Product assortment cost comparison:** Provides a graphical visualization of product assortment, by unit cost range and measure. A dropdown allows users to select the square footage rating to see how assortment differs.
- › **Remaining research questions:** Suggestions for research that would require collection of primary source data.

Additionally, the tab provides links to the various market indicators collected and a “read me” with a brief introduction to the workbook. Under each column in the summary view is a data link, which will take the user directly to the relevant source in the workbook.

Figure 2-15 shows a screen shot of the summary view tab.

Figure 2-15: Air Cleaner Summary Tab Snapshot



### 2.3.4.2. Measure Quantitative Data Tab

Measure quantitative data includes four market indicators for each measure:

- › **Retail availability:** Both national and California-specific data from the ENERGY STAR qualified product list and retailer websites. Data collected includes the number of brands, number of qualified models, and measure availability at the top five retailers whose websites distinguished between ENERGY STAR and non-ENERGY STAR air cleaners. Additionally, includes information on how easily the ENERGY STAR designation was located on each retailers’ website.

- › **Unit cost:** Average unit cost collected during retailer website visits.
- › **Unit penetration and shipments:** Both national and regional data for ENERGY STAR shipments, ENERGY STAR market penetration, and proportion of households who have air cleaners.
- › **Unit energy savings:** National data for unit energy consumption, unit energy savings, and lifecycle.

Figure 2-16 shows a screen shot of the measure quantitative data tab.

Figure 2-16: Air Cleaner Measure Quantitative Data Tab Snapshot

		Year	2015	2015	2015	2015	2015	2015	2015	2015	
		Territory	National	National	National	National	California	National	National	California	California
		Source #	1	10	10, 17-21			17-21	17-21	17, 19, 20, 21	17-21
		Note	See codes and specs data tab								
		Availability summary: Calculated from retailer data to right									
Meas #	Measure	ENERGY STAR Efficiency requirement CADR/Watt	# Qualifying Models	# of brands	Retail Online Availability (Percent that carry) (n=5)	Retail In-store Availability (Percent that carry) (n=5)	Retailer ENERGY STAR Designation on Website (out of 8 stores)	Average # Models Available Online	Average # Models Available In-store	# of Stores that stock in store (out of 6)	
1	Air Cleaner	N/A	N/A	58	100%	40%		35.2	9.4	3	
2	ENERGY STAR Air Cleaner		2	182	45	100%	80%	5	22.2	7	5

### 2.3.4.3. Measure Qualitative Data Tab

The measure qualitative data tab provides information at the device level and includes a detailed description, non-energy benefits and impacts, health benefits, health risks, test methods and measurement concerns, sources of savings uncertainty, technology features, barriers to adoption, market actors, and major programs targeting ENERGY STAR measure..

Figure 2-17 shows a screen shot of the measure qualitative data tab.

Figure 2-17: Air Cleaner Measure Qualitative Data Tab Snapshot

Measure	Description	Non-Energy benefits and impacts		Health benefits	Health risks	Test method and measurement concerns
		2011	2009	2009	2015	2011
		1	14	14	9, 12, 13	15, 16
All Air Cleaners	An electric cord-connected, portable appliance with the primary function of removing particulate matter from the air and which can be moved from room to room	There are no NEBs of efficient air cleaners over inefficient ones.	The use of air cleaners (including those with high efficiency particulate air or HEPA filters) may help reduce the amount of airborne pollutants, but do not consistently and effectively reduce adverse health effects caused by these pollutants.	Some produce ozone as a byproduct which, at ground level, is a respiratory irritant. This prompted California to create regulations around the maximum allowable limit of ozone emitted. The EPA guidelines and the California standard is no more than .050ppm.	The CADR testing approach was revised in 2011 when AHAM expressed concern about the variability in test results due to the difficulty measuring fine dust particles. They suggested using multiple samples for verification testing. The EPA accepted this as long as the mean of the multiple tests was equal or better to the ENERGY STAR requirements.	

### 2.3.4.4. Codes and Specs Data Tab

The codes and specs data tab provides data on past and current ENERGY STAR specifications and the California Environmental Protection Agency code. Each specification includes information on the measure requirement and each code or specification’s effective date.

Figure 2-18 shows a screen shot of the codes and specs data tab.

Figure 2-18: Air Cleaner Codes and Specs Data Tab Snapshot

Specification				
Spec	Requirement	Effective Date	Source ID	
ENERGY STAR certified air cleaners	To be considered for ENERGY STAR certification, minimum of 50 CADR	2004	25	
ENERGY STAR certified air cleaners	Standby Power Requirement = 2.0 Watts	2004	25	
ENERGY STAR certified air cleaners	UL Safety Requirement = ozone emission concentration less than 50	2004	25	
ENERGY STAR certified air cleaners	2.0 CADR/Watt (Dust)	2004	4	
ENERGY STAR certified air cleaners	2.0 CADR/Watt (Dust)	2011	1	
California certified air cleaners	Ozone emission concentration less than 50ppb	10/18/2010	9	

### 2.3.5. Water Heaters

#### 2.3.5.1. Summary View Tab

The summary view tab displays current market data, a comparison of work paper and market data, and a code and specification timeline:

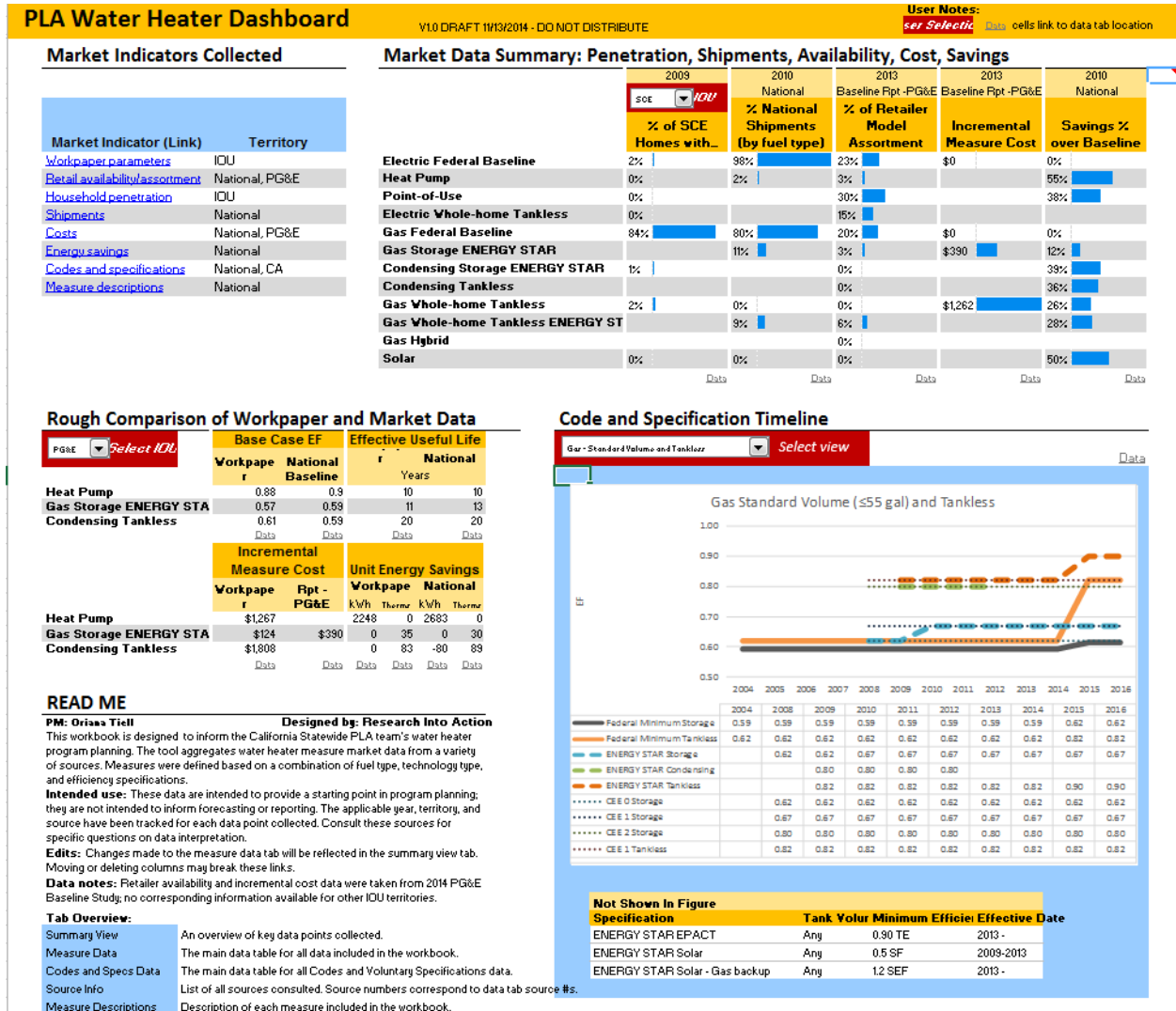
- › **Market data:** Provides national and IOU level data for each water heater measure, including penetration, shipments, availability, cost, and savings. A dropdown allows users to select an IOU to display relative penetration of each measure in the IOU service territory.

- › **Comparison of work paper and market data:** Provides a rough comparison between IOU workpaper and market data. Data comparisons include base case energy factor (EF), effective useful life, incremental measure cost, and unit energy savings for work paper measures. A dropdown allows users to select an IOU to display relative work paper information.
- › **Codes and specification timeline:** Provides a graphical visualization federal, ENERGY STAR, and CEE codes and specifications, by year. A dropdown allows users to select the fuel source and between standard and large volume tanks.

Additionally, the tab provides links to the various market indicators collected and a “read me” with a brief introduction to the workbook. Under each column in the summary view is a data link, which will take the user directly to the relevant source in the workbook.

Figure 2-19 shows a screen shot of the summary view tab.

Figure 2-19: Water Heater Summary Tab Snapshot



### 2.3.5.2. Additional Research Tab

The additional research questions tab provides a summary of data collected to address specific questions regarding water heaters suggested by IOUs through a separate contract, the forthcoming Work Paper Update Project. Information found on this tab includes

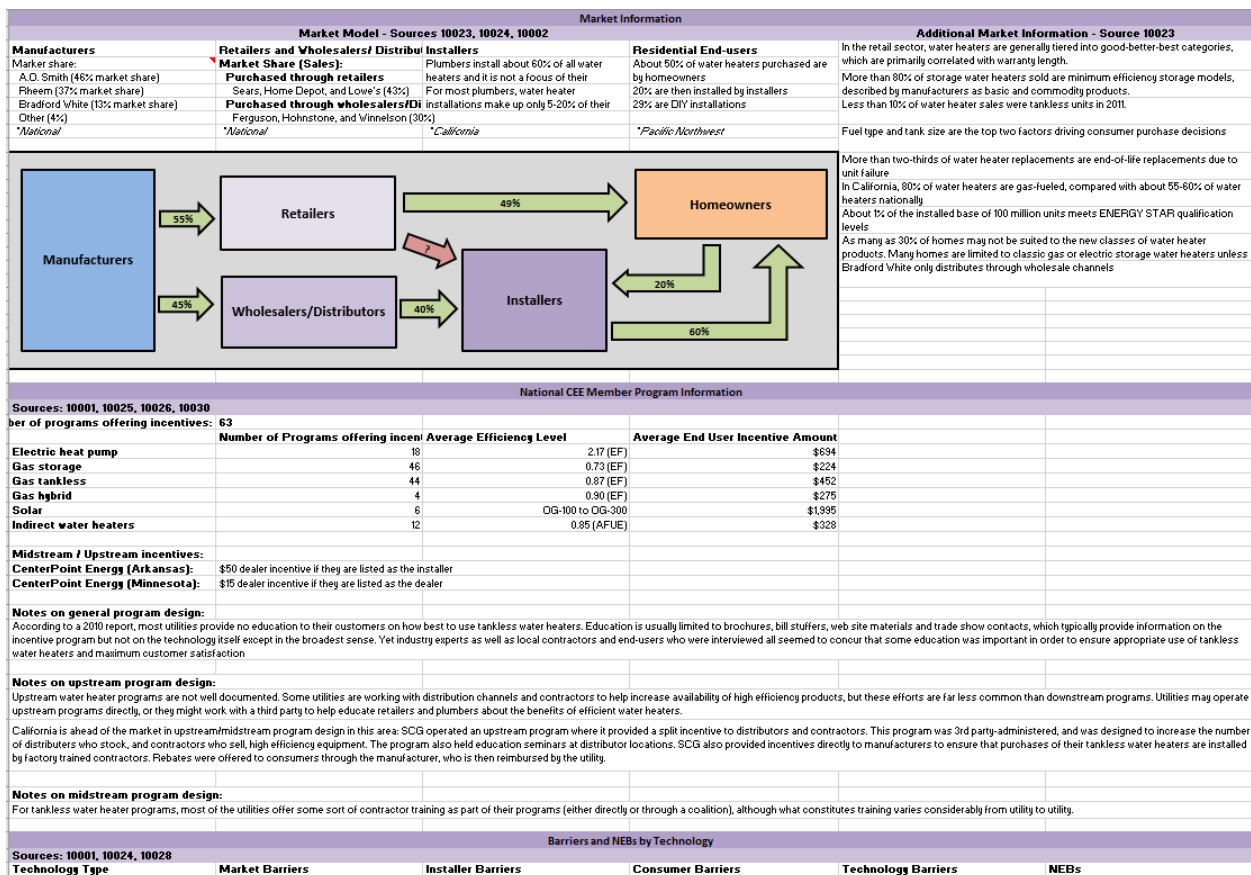
- › Market information including a market model with market actors and the proportion of water heaters sales allocated to each market actor.
- › National CEE member program information including number of programs, average efficiency level, and average incentive amount, by measure. Also included are program design notes for both midstream and upstream programs.
- › Market, installer, consumer, and technology barriers by technology type, including emerging technologies and related non-energy benefits (NEBs).

## Residential Solutions Workbook Phase II: Measure View

- › Market barriers and suggestions on program design elements to overcome each barrier.
- › Detailed information on realization rates and installation barriers for tankless water heaters.
- › Additional research questions that would require collection of primary source data.
- › A summary of program design recommendations that emerged through secondary research.

Figure 2-20 shows a screen shot of the additional research tab.

**Figure 2-20: Water Heater Additional Research Tab Snapshot**



### 2.3.5.3. Program Data Tab

The program data tab provides detailed information on programs that currently provide incentives for residential water heaters. Information provided includes the name of the utility or organization, measures currently incented, the efficiency level (EF), and the incentive amount.

Figure 2-21 shows a screen shot of the program data tab.

Figure 2-21: Water Heater Program Data Tab Snapshot

Source: 10025	Program, Other Information	State or Province	Offers at least one incentive	Gas Storage								
				Incented measure	Efficiency Level 1	Rebate 1	Efficiency Level 2	Rebate 2	Efficiency Level 3	Rebate 3	Note	
Alliant Energy		IA	1	1	0.67	75						
Alliant Energy		MN	1	1	0.67	50						
Ameren Illinois		IL	1									
Ameren Missouri	Owner Occupied	MO	1	1	0.67	125						
Ameren Missouri	Landlords	MO										
Atmos Energy		KY	1	1	0.62	200	0.67	300	0.82	400		
Atmos Energy		CO	1									
Atmos Energy		TX	1	1	0.67	100	0.67	200				
Avista Utilities		WA	1	1	0.6	20	0.62	20				Confirmed DS
Avista Utilities		ID										
Avista Utilities		OR										
Baltimore Gas and Electric Company		MD	1									
Berkshire Gas Company	GasNetworks	MA	1	1	0.67	100						
Black Hills Energy		CO	1	1	0.67	75	0.8	300				
Black Hills Energy		IA	1	1	0.67	150	0.8	300	0.67	425		
Cascade Natural Gas		WA	1	1	0.64	40						Confirmed DS
City of Palo Alto Utilities		CA	1	1	0.67	80	0.8	150				
Columbia Gas of Massachusetts	GasNetworks	MA	1	1	0.67	100						
Columbia Gas of Ohio		OH										
Con Edison		NY	1	1	0.67	100						
Connecticut Natural Gas		CT	1	1	0.67	100						
Consumers Energy		MI	1	1	0.67	75						
DC Sustainable Energy Utility		DC	1	1	0.67	100	0.8	400				
Delta Natural Gas		KY	1	1	0.62	200						
DTE Energy		MI	1	1	0.67	75						
Duke Energy		KY										
Efficiency Maine		ME	1									
Efficiency Vermont		VT										
Energy Trust of Oregon		OR	1	1	0.67	125						
Energy Trust of Oregon		WA	1	1	0.62	35	0.67	150				Confirmed DS
Focus on Energy Wisconsin		WI										
FortisBC		BC	1	1	0.67	200	0.8	1000				
Gaz Métro		QC	1									
Great Plains Natural Gas		MN	1	1	0.64	85	0.67	100				

### 2.3.5.4. Measure Data Tab

The measure data tab includes six market indicators for each measure:

- › **Measure information:** Information on any sub types for each measure, residential tank size range, and input (Btu/h).
- › **Work paper data:** IOU level data compiled from work papers. Data includes, average tank size (gallons), measure effective useful life (EUL), base case EF, minimum measure EF, base case equipment cost, measure equipment cost, labor cost, measure incremental cost, UEC, and UES, by IOU.
- › **Availability, model counts, and assortment:** National and IOU level data including number of ENERGY STAR qualified models, number of brands and models, and in-store and online retail availability. Additionally, information on the proportion of each measure in retailers’ assortment is included.
- › **Unit penetration and shipments:** National and IOU level data including penetration, unit shipments, ENERGY STAR shipments, percent of shipments within each fuel type, and percent of shipments within fuel and technology types.
- › **Unit cost:** National, regional, and IOU level data including unit costs, instillation costs, and incremental costs.



- › **Unit energy savings:** National data including unit energy consumption, unit energy savings, savings over baseline, summer peak demand kW, winter peak demand kW, lifecycle, estimated savings based on 2015 revised codes and specifications, and 2015 California deemed savings.

Figure 2-22 shows a screen shot of the measure data tab.

**Figure 2-22: Water Heater Measure Data Tab Snapshot**

Measure		Measure information										
Year		2010	2010		2014	2014	2014	2014	2014	2014		
Territory		National	National		PG&E	PG&E	PG&E	PG&E	PG&E	PG&E		
Source #		10013	10013		10011-2	10011-2	10011-2	10011-2	10011-2	10011-2		
Note					Includes commercial applications	Includes commercial applications	Includes commercial applications	Includes commercial applications	Years			
Fuel	Measure	Description	Subtype	Residential Tank Size (gal)	Max Input (Btu/h)	Workpaper Measure	% 40 Gallon	% 50 Gallon	% 60 Gallon	Average Tank Size (gallon)	Measure EUL (Effective Useful Life)	Base Case E
Electric	Electric Federal Baseline	See Measure Description Tab		20 - 55, 55-12	40,956	No						
Electric	Heat Pump	See Measure Description Tab	Integrated or add-on			Yes	Unknown	Unknown	Unknown	58.7	10	0.88
Electric	Point-of-Use	See Measure Description Tab				No						
Electric	Electric Whole-home Tankless	See Measure Description Tab				No						
Electric	High Efficiency Electric Storage	See Measure Description Tab				Yes						
Gas	Gas Federal Baseline	See Measure Description Tab		20-55, 55-10	75,000	No						
Gas	Gas Storage ENERGY STAR	See Measure Description Tab				Yes	50%	48%	2%	Unknown	11	0.57
Gas	Condensing Storage ENERGY STAR	See Measure Description Tab				No						
Gas	Condensing Tankless	See Measure Description Tab				Yes	Unknown	Unknown	Unknown	Unknown	20	0.61
Gas	Gas Whole-home Tankless	See Measure Description Tab		< 2	200,000	No						
Gas	Gas Whole-home Tankless ENERGY STAR	See Measure Description Tab				No						
Gas	Gas Hybrid	See Measure Description Tab				No						
Solar	Solar	See Measure Description Tab	Gas or electric backup			No						

### 2.3.5.5. Codes and Specs Data

The codes and specs data tab provides data on past and current specifications from DOE, ENERGY STAR, and CEE. Each specification includes the tank size, requirement units, requirement, and effective date.

Figure 2-23 shows a screen shot of the codes and specs data tab.

Figure 2-23: Water Heater Codes and Specs Data Tab Snapshot

		Specification						
Fuel	Spec	Tank Size	Req	Requirement	Effective Date	Source ID		
Electric	Federal Minimum Storage	Any	EF		0.90	Jan-04	10013	
Electric	Federal Minimum Storage	≤55 gal	EF		0.95	Apr-15	10013	
Electric	Federal Minimum Storage	>55 gal	EF		1.99	Apr-15	10013	
Electric	Federal Minimum Tankless		EF		0.93	Jan-04	10013	
Electric	Federal Minimum Tankless		EF		0.93	Apr-15	10013	
Electric	ENERGY STAR Storage	Any	EF		2.00	Jan-09	10014	
Electric	ENERGY STAR Storage	Any	EF		2.00	Jul-13	10015	
Electric	ENERGY STAR Storage	≤55 gal	EF		2.00	Apr-15	10016	
Electric	ENERGY STAR Storage	>55 gal	EF		2.20	Apr-15	10016	
Gas	Federal Minimum Storage	Any	EF		0.59	Jan-04	10013	
Gas	Federal Minimum Storage	≤55 gal	EF		0.62	Apr-15	10013	
Gas	Federal Minimum Storage	>55 gal	EF		0.76	Apr-15	10013	
Gas	Federal Minimum Tankless		EF		0.62	Jan-04	10013	
Gas	Federal Minimum Tankless		EF		0.82	Apr-15	10013	
Gas	ENERGY STAR Storage	Any	EF		0.62	Jan-08	10014	
Gas	ENERGY STAR Storage	Any	EF		0.67	Sep-10	10014	
Gas	ENERGY STAR Storage	Any	EF		0.67	Jul-13	10015	
Gas	ENERGY STAR Storage	≤55 gal	EF		0.67	Apr-15	10016	
Gas	ENERGY STAR Storage	>55 gal	EF		0.77	Apr-15	10016	
Gas	ENERGY STAR Condensing	Any	EF		0.80	Jan-09	10014	

### 2.3.5.6. Measure Description Tab

The measure description tab provides a detail description for each water heater measure in the workbook.

Figure 2-24 shows a screen shot of the measure description tab.

Figure 2-24: Water Heater Measure Description Tab Snapshot

Measure	Description
Electric Baseline	Water heaters with an insulated storage tank generally ranging from 20 to 80 gallons.
Electric Heat Pump	Storage tank water heaters that use a vapor compressor refrigeration cycle to concentrate ambient heat, which is used to assist in heating water in the tank.
Electric Point-of-Use	A point-of-use (POU) water heaters are small, tankless, units generally located near the sink, shower, or bath where the water is used, instead of a centralized unit. POU water heaters are not suitable for primary water heating, but rather supplement a central water heater to reduce heat loss.
Electric Whole-home Tankless	Water heaters that do not have a storage tank. A electric burner heats the water only when there is demand.
High Efficiency Electric Storage	A water heater with a storage tank that has a greater amount of insulation than an electric baseline water heater.
Gas Baseline	Water heaters with an insulated storage tank generally ranging from 20 to 80 gallons.
Gas Condensing Storage ENERGY STAR	Storage tank water heaters that do not have standing pilots and have an inducer fan that acts as a flue damper to reduce off-cycle losses. Condensing storage water heaters utilize captured gasses to heat the water in the tank.
Gas Condensing Tankless	A gas burner heats the water only when there is demand. Unlike conventional tankless water heaters, condensing tankless water heaters capture the additional heat from the exhaust gases to heat the water.
Gas Storage ENERGY STAR	Storage tank water heaters that use a variety of technologies to reach ENERGY STAR's minimum specification.
Gas Whole-home Tankless	Water heaters that do not have a storage tank. A gas burner heats the water only when there is demand.
Gas Whole-home Tankless ENERGY STAR	Without a storage tank, a gas burner heats the water only when there is demand. Efficiency meets ENERGY STAR's minimum specification.
Gas Hybrid	A water heater that captures the advantages of both tankless and storage tank technologies. Hybrid water heaters have a small tank that minimizes standby losses.
Solar (gas or electric backup)	Water heaters that utilize solar energy to heat water. Solar water heaters are generally mounted on to the roof of a home where water is heated through a copper heat exchanger and stored in an insulated tank for household use. Because solar water heaters work intermittently, low capacity gas or electric back-up water heaters are used to meet household demand.

## 2.4. Market Indicators

The RSW II tools aggregate data for nine market indicators. Although most data are aggregated at the measure level, several of the qualitative market indicators are presented at the device level. Data collection focused on secondary research in published sources, but included one primary data collection activity (retail availability and cost). Most market indicator data is at the national level, but where available, the team collected California- or IOU-specific data. As noted above, the header rows in the data tabs identify the market indicator, scope of the data (national, state, or IOU territory), year, and the source number. The market indicators were similar across products, but tailored somewhat to the features of each product (Table 2-2). The sections below present information about the market indicators collected for each RSW II tool, including the market indicator definition, methods and sources of data collection, and any notes or assumptions made during the data collection process.

**Table 2-2: Overview of Market Indicators Collected for Each Device**

	ADVANCED POWER STRIPS	CLOTHES DRYERS	POOL PUMPS	AIR CLEANERS	WATER HEATERS
Retail availability	X	X	X	X	X
Costs	X	X	X	X	X
Energy savings	X	X	X	X	X
Existing program information	X	X	X	X	X
Codes and Specifications		X	X	X	X
Penetration and shipments		X	X	X	X
Device barriers and opportunities	X	X		X	X
Measure applications	X	X			
Measure features and trends	X	X			

### 2.4.1. Advanced Power Strips

**Table 2-3: RSW Market Indicator Details: Device Barriers and Opportunities**

Definition	Barriers and opportunities to increasing market penetration of advanced power strips.
Data collection method	Secondary
Data collection notes	Data reviewed included: energy savings sources of uncertainty, barriers to adoption for utilities and consumers, consumer awareness, consumer behavior, market failures, market actors, and program opportunities.
Sources	Northeast Energy Efficiency Partnerships (NEEP) 2011, American Council for an Energy-Efficient Economy (ACEEE) 2014a, Research Into Action, New York State Energy Research and Development Authority (NYSERDA), Northwest Regional

## Residential Solutions Workbook Phase II: Measure View

Technical Forum (RTF), Fraunhofer, NMR Consulting, ACEEE 2014b, Energy and Resource Solutions

Comments

**Table 2-4: RSW Market Indicator Details: Energy Savings**

Definition	Estimated savings associated with measures over pre-conditions and current practice.
Data collection method	Secondary
Data collection notes	Data compiled from various sources published between 2005 and 2014.
Sources	NYSERDA, Northwest RTF, ECOS Consulting, San Diego Gas and Electric (SDG&E) Smart Power Strips Work Paper, Navigant Consulting
Comments	Not all sources provided savings data on all measures. End uses were generally consistent between sources (i.e., home entertainment vs. home office), however, devices connected to APS varied by source.

**Table 2-5: RSW Market Indicator Details: Measure Applications**

Definition	Measure descriptions and intended use.
Data collection method	Secondary
Data collection notes	Data reviewed included: measure description, additional terminology used, appropriate location for each measure, circumstance of use, and appropriate end-use.
Sources	NEEP 2013, Northwest RTF, Research Into Action
Comments	

**Table 2-6: RSW Market Indicator Details: Measure Features, Trends, and Limitations**

Definition	Features associated with each measure, upcoming technology trends, and any limitations associated with each measure.
Data collection method	Secondary
Data collection notes	Data reviewed included: limitations associated with each measure, any upcoming technology trends, and top occupancy sensor models currently available.
Sources	ECOS Consulting, ACEEE 2014a, Power strip manufacturers websites
Comments	Most sources provided details on Tier 2, Occupancy sensing power strips only. The research team was unable to locate any technology trends for other measures.

**Table 2-7: RSW Market Indicator Details: Existing Program Information**

Definition	Current and past programs that provide utility support for advanced power strips.
Data collection method	Secondary

## Residential Solutions Workbook Phase II: Measure View

Data collection notes	Data compiled included program location, program design, targeted measure, incentive type (i.e., mail-in rebate, direct install, coupon), and incentive amount.
Sources	Consortium for Energy Efficiency (CEE), ESource, and private correspondence with manufacturers.
Comments	There are likely other Tier 2 device pilots that are not available at this time.

**Table 2-8: RSW Market Indicator Details: Retail Availability and Unit Costs**

Definition	Measure availability and cost at 17 retailers (both online and brick and mortar with website)
Data collection method	Primary
Data collection notes	<p>To determine product availability for advanced power strips (APS) the research team visited retailer websites. To select which retailer websites to visit, we consulted two sources. One source provided the top consumer electronics retailers by 2013 sales, and the other source provided the top retailers by 2013 sales.</p> <p>Combing the top ten retailers from these sources resulted in a list of 17 retailers. The research team then visited each retailers' website in November of 2014 and documented their selection of APS; collecting details on power strips displayed that matched the six APS measures. Details included the APS brand, model number, retail price, online availability, and if applicable, in-store availability.</p>
Sources	National Retail Federation, Dealscope, Amazon, Apple, Best Buy, CDW, Costco, CVS, Walgreens, Dell, GameStop, Home Depot, HP, Kroger, Safeway, Staples, Target, Walmart
Comments	Two retailers (Kroger and Safeway) were included on the top ten retailers in 2014 by sales, but do not provide information on product availability on their websites.

### 2.4.2. Clothes Dryers

**Table 2-9: RSW Market Indicator Details: Sizes**

Definition	Drum capacity (cubic feet)
Data collection method	Secondary
Data collection notes	Ranges available in current market
Sources	ENERGY STAR Product Finder, ENERGY STAR Emerging Technology Award, CNET, NRDC A Closer Look at Energy Efficiency Test Procedures and Savings Opportunities
Comments	

**Table 2-10: RSW Market Indicator Details: Efficiency Requirements**

Definition	Energy factor requirements and amended standards of DOE's regulations and the ENERGY STAR criteria for clothes dryers.
Data collection method	Secondary

## Residential Solutions Workbook Phase II: Measure View

Data collection notes	Energy Factor is defined as number of pounds of clothes dried per kWh
Sources	ENERGY STAR Clothes Dryers Key Product Criteria, DOE Residential Clothes Dryer Standards 2014, ENERGY STAR Emerging Technology Award Winners 2014
Comments	

**Table 2-11: RSW Market Indicator Details: Number of Models**

Definition	Number of models available on current market
Data collection method	Primary
Data collection notes	The research team visited three retailers' websites in October of 2014 and documented their selection of clothes dryers; collecting details on from most prominent clothes dryer brands that matched the 12 clothes dryer measures. Details included the brand, model number, retail price, and online availability.
Sources	Energy Star Product Finder, Sears' Website, Lowe's Website, Home Depot's Website
Comments	

**Table 2-12: RSW Market Indicator Details: Number of Brands**

Definition	Number of brands available on current market
Data collection method	Primary
Data collection notes	The research team visited three retailers' websites in October of 2014 and documented their selection of clothes dryers; collecting details on from most prominent clothes dryer brands that matched the 12 clothes dryer measures. Details included the brand, model number, retail price, and online availability.
Sources	Energy Star Product Finder, Sears' Website, Lowe's Website, Home Depot's Website
Comments	

**Table 2-13: RSW Market Indicator Details: Retail Online Availability**

Definition	Retail online availability
Data collection method	Primary
Data collection notes	'Yes' indicates that the measure was easily findable on one or more of three prominent online retailers' websites.
Sources	Energy Star Product Finder, Sears' Website, Lowe's Website, Home Depot's Website
Comments	

**Table 2-14: RSW Market Indicator Details: Average Models Available Online per Store**

Definition	Average number of models available online in prominent retail stores
------------	--

## Residential Solutions Workbook Phase II: Measure View

Data collection method	Primary
Data collection notes	Counted number of models available online at 3 prominent retail stores (Sears, Lowe's, and The Home Depot) and calculated average available per store
Sources	Energy Star Product Finder, Sears' Website, Lowe's Website, Home Depot's Website
Comments	

**Table 2-15: RSW Market Indicator Details: Unit Cost**

Definition	Average cost per unit
Data collection method	Primary
Data collection notes	The research team visited three retailers' websites in October of 2014 and documented their selection of clothes dryers; collecting details on from most prominent clothes dryer brands that matched the 12 clothes dryer measures. Details included the brand, model number, retail price, and online availability.
Sources	Energy Star Product Finder, Sears' Website, Lowe's Website, Home Depot's Website
Comments	

**Table 2-16: RSW Market Indicator Details: Unit Shipments**

Definition	Historical shipments of electric and gas clothes dryers (in millions) in 2010
Data collection method	Secondary
Data collection notes	
Sources	DOE Technical Support Document 2011
Comments	

**Table 2-17: RSW Market Indicator Details: Penetration of Sizes**

Definition	Clothes dryer product class market shares
Data collection method	Secondary
Data collection notes	
Sources	DOE Technical Support Document 2011
Comments	

**Table 2-18: RSW Market Indicator Details: Market Penetration**

Definition	Percent of households with a certain type of clothes dryer
Data collection method	Secondary

## Residential Solutions Workbook Phase II: Measure View

Data collection notes	Data reviewed included: shipment analysis, California Statewide Residential Appliance Saturation Study (RASS) and California Lighting and Appliance Saturation Study (CLASS). Collected percent that have a clothes dryer in each electric utility and across all utilities in 2009 and 2012.
Sources	CLASS 2012, CLASS 2009, and DOE 2011 Technical Support Document
Comments	While penetration data on summary tab for standard clothes dryers comes from recent CLASS data, penetration of compact clothes dryers comes from DOE

**Table 2-19: RSW Market Indicator Details: Energy Use**

Definition	Average annual energy use in kWh (assumes 283 cycles/year)
Data collection method	Secondary
Data collection notes	Note that clothes dryer energy use varies depending on which DOE test procedure is used, D1 or D2. D2 test procedure results are displayed on the summary tab, and both inputs are provided in the quantitative data tab.
Sources	ENERGY STAR Product Finder, ENERGY STAR Market & Industry Scoping Report Residential Clothes Dryers 2011, Ecova Analysis of Potential Energy Savings from Heat Pump Clothes Dryers in North America
Comments	

**Table 2-20: RSW Market Indicator Details: Unit Energy Savings**

Definition	Unit energy savings over baseline
Data collection method	Secondary
Data collection notes	For electric clothes dryer savings is UEC – UEC for standard electric model. For gas clothes dryer savings is UEC – UEC for standard gas model. Heat pump UES is based on a potential energy savings study
Sources	ENERGY STAR Product Finder, ENERGY STAR Market & Industry Scoping Report Residential Clothes Dryers 2011, Ecova Analysis of Potential Energy Savings from Heat Pump Clothes Dryers in North America
Comments	

**Table 2-21: RSW Market Indicator Details: Programs Incenting Measure**

Definition	Indicates whether measure is incented by a program
Data collection method	Secondary
Data collection notes	Based on ENERGY STAR rebate finder
Sources	ENERGY STAR Rebate Finder
Comments	It is unclear whether 'highly efficient models' includes compact models



**Table 2-22: RSW Market Indicator Details: Non-Energy Benefits**

Definition	Benefits of particular measures not related to energy use or savings
Data collection method	Secondary
Data collection notes	
Sources	ENERGY STAR Product Finder, Research Into Action Key MT Characteristics of Devices and Final Prioritization, Ecova The Time is Ripe for Paying Attention to Clothes Drying Technology
Comments	

**Table 2-23: RSW Market Indicator Details: Barriers to Adoption**

Definition	Consumer barriers to purchasing a particular measure
Data collection method	Secondary
Data collection notes	
Sources	Research Into Action Key MT Characteristics of Devices and Final Prioritization, NEEA Clothes Dryer Testing 2014
Comments	

**Table 2-24: RSW Market Indicator Details: Technology Trends**

Definition	Current technology trends and areas to target
Data collection method	Secondary
Data collection notes	
Sources	HEER/BCE Program & Technology Review of Two Residential Product Programs, Ecova The Time is Ripe for Paying Attention to Clothes Drying Technology
Comments	

**Table 2-25: RSW Market Indicator Details: Key Trends**

Definition	Other key trends such as awareness and availability of measures
Data collection method	Secondary
Data collection notes	
Sources	HEER/BCE Program & Technology Review of Two Residential Product Programs
Comments	

### 2.4.3. Pool Pumps

**Table 2-26: RSW Market Indicator Details: Availability**

Definition	Measure availability at four retailers (Amazon, Leslie's Pool Supply, Best Buy Pool Supplies, and Poolssupplies.com)
Data collection method	Primary
Data collection notes	To determine product availability for pool pumps the research team visited four retailer websites. We selected the four retailers based on google.com search engine results. The research team noted which models from the APSP (2014) list were available at each retailer. Counts of number of brands and number of models that fit into each measure definition according to APSP are also provided here. A count of ENERGY STAR models that fit each measure type are also located here.
Sources	Amazon (2014), Leslie's Pool Supply (2014), BestBuy Pool Supplies (2014), and Poolssupplies.com (2014). Association of Pool and Spa Professionals (2014), ENERGY STAR (2014).
Comments	

**Table 2-27: RSW Market Indicator Details: Program Eligible Models**

Definition	IOU energy efficiency program eligibility
Data collection method	Secondary
Data collection notes	The research team examined program websites to collect data on eligible equipment and incentive amounts. Counts of the number of program eligible models by IOU are listed by measure type and CEE Tier.
Sources	Pacific Gas and Electric (2014), Southern California Edison (2014), San Diego Gas and Electric (2014); Consortium for Energy Efficiency (2014).
Comments	

**Table 2-28: RSW Market Indicator Details: Costs**

Definition	Average cost per unit and installation costs
Data collection method	Primary and Secondary
Data collection notes	To determine product availability for pool pumps the research team visited retailer websites. We selected the four retailers based on google.com search engine results. Using the four retailers identified, the research team visited each website and recorded the price of pool pumps in the APSP list of pool pumps. We provided costs for pumps on the list at these four retailers.  Installation estimate costs are provided from three sources: PG&E's Work Paper on Pool Pumps (2012), ENERGY STAR, and Homewyse (2014)
Sources	Amazon (2014), Leslie's Pool Supply (2014), Poolsupplies.com (2014), BestBuy Pool Supplies (2014), The Association of Pool and Spa Professionals (2014), PG&E's Work Paper on Pool Pumps (2012), ENERGY STAR, and Homewyse (2014)

Comments

**Table 2-29: RSW Market Indicator Details: Penetration and Shipments**

Definition	Number of pool pumps in California by type.
Data collection method	Secondary
Data collection notes	The CEC provides the number of pool pumps by type as of 2009.
Sources	California Energy Commission (2013).
Comments	This data is six years old and the numbers have likely changed noticeably since 2009.

**Table 2-30: RSW Market Indicator Details: Energy Savings and Sources of Uncertainty**

Definition	Estimated savings associated with measures over baseline
Data collection method	Secondary
Data collection notes	Data compiled from various sources published between 2010 and 2014. Three sources are provided” 1) a model assortment of data using APSP data, 2) a PG&E Work Paper that provides estimates of dual speed and VSPs, but not for CEE tiers, and 3) a California Technical Potential study that offers savings estimates for VSPs.
Sources	Consortium for Energy Efficiency (2014), Energy Star (2013), Pacific Gas and Electric (2013), Navigant 2013 Technical Potential Study; The Association of Pool and Spa Professionals (2014)
Comments	Not all sources provided savings data on all measures.

**Table 2-31: RSW Market Indicator Details: Non-energy Benefits**

Definition	Four key non-energy benefits of VSPs are noted here
Data collection method	Secondary
Data collection notes	The research team identified five total benefits of VSPs, of which four are non-energy benefits.
Sources	Southern California Edison (2012)
Comments	

**Table 2-32: RSW Market Indicator Details: Market and Technology Trends**

Definition	How the marketplace is receiving variable speed pumps.
Data collection method	Secondary
Data collection notes	
Sources	Southern California Edison (2012), Leslie’s Pool Supply (2014)

Comments	<p>Retailers and installers appear to be skipping dual speed (and multi-speed) and going straight to VSPs. The major retailer, Leslie's Pool supply, does not offer dual-speed pumps on their national website. They only offer single speed and VSPs.</p> <p>VSPs appear to be the dominant pool pump offered in California. Single speed pumps appear to be offered by national retailers, but that is not applicable to CA (and FL) where single speed pumps are outlawed.</p> <p>In 2012, 100% of surveyed installers said they have installed VSPs, while only 22% said they sold dual speed pumps.</p>
----------	--

**Table 2-33: RSW Market Indicator Details: Barriers to Adoption**

Definition	Barriers to use of variable speed pumps
Data collection method	Secondary
Data collection notes	The research team assessed the following barriers to adoption of VSPs: cost, availability, contractor awareness of benefits, customer awareness of benefits, any additional equipment needed, and early replacement aversion.
Sources	Southern California Edison (2012)
Comments	

**Table 2-34: RSW Market Indicator Details: Major Programs Targeting Measure**

Definition	The research team identified programs in Florida that are similar to California, because like California, Florida outlawed the installation of new single-speed pumps.
Data collection method	Secondary
Data collection notes	The Professional Poolcare source is an article about the energy efficiency demands on pool pumps in Florida and the the Gulf Power source provides information about one Florida utility and their pool pump program.
Sources	Professional Poolcare, Gulf Power
Comments	

**Table 2-35: RSW Market Indicator Details: Market Actors**

Definition	Identifies three main market actors in pool pump industry, manufacturers, retailers, and installation contractors.
Data collection method	Secondary
Data collection notes	The SCE 2012 report identifies the primary manufacturers and their market share. The report also provides insights into the activity level of pool pump contractors. All retailers in the pool market appear to sell pool pumps but no specific market share of a retailer is noted.
Sources	Southern California Edison (2012)
Comments	

## 2.4.4. Air Cleaners

**Table 2-36: RSW Market Indicator Details: Codes and Specifications**

Definition	Provides voluntary standards for ENERGY STAR Certified Air Cleaner
Data collection method	Secondary
Data collection notes	The research team visited the ENERGY STAR website to ascertain the efficiency standard for certified room air cleaners. This yielded an up-to-date specification. The AHAM report included information about the standard being set in 2004.
Sources	ENERGY STAR Website 2011; Association of Home Appliance Manufacturers (AHAM) 2004.
Comments	There are no mandatory federal energy codes for air cleaners.

**Table 2-37: RSW Market Indicator Details: Retail Availability**

Definition	Air cleaner availability at six retailers (online and brick and mortar)
Data collection method	Primary
Data collection notes	To determine product availability for room air cleaners, the research team visited retailer websites. To select which retailer websites to visit, we considered market share of retailers. There is considerable consolidation among retailers. According to the Wall Street Journal, three stores (Sears, Lowe's, and Home Depot) account for 60% of market share for home appliances. The team visited these sites and five others, locating a total of five of eight retailers that included air cleaner ENERGY STAR designation on their websites. If the website had a menu option allowing the user to filter ENERGY STAR-certified units or had an ENERGY STAR logo next to qualified products in the results list, it was categorized as easily-findable. If the website required the user to select each product individually and read through a list of product details to ascertain if the unit was ENERGY STAR-certified, it was categorized as findable with difficulty.
Sources	Sears Website; Lowe's Website; Home Depot Website; Staples Website; Wal-Mart Website; Wall Street Journal Website 2014.
Comments	The research team could only collect information on retail availability for retailers that distinguished between ENERGY STAR certified air cleaners and non-ENERGY STAR certified air cleaners.  When performing a search for air cleaners on a retailer's website, replacement filters always appeared in the results. The research team removed these results from the list when counting the number of air cleaners available.

**Table 2-38: RSW Market Indicator Details: Costs**

Definition	Average cost per unit by room size capacity, over or under 400 square feet.
Data collection method	Primary and Secondary
Data collection notes	To determine average unit costs for room air cleaners, the research team visited retailer websites. Since the price of the unit tends to increase with capacity, the research team examined price of air cleaners by room size capacity in January 2015. The two

## Residential Solutions Workbook Phase II: Measure View

	capacities (over and under 400 square feet) are based on retailer capacity designations. The information on unit costs comes from the major retailer websites that distinguish both room size and ENERGY STAR certification on their websites.
Sources	Sears Website; Home Depot Website
Comments	Wal-Mart distinguished room size on their website, but only had one air cleaner with capacity above 400 square feet. For this reason, it was excluded from the cost analysis.

**Table 2-39: RSW Market Indicator Details: Device Barriers**

Definition	Barriers to Purchasing an ENERGY STAR certified room air cleaner
Data collection method	Primary and Secondary
Data collection notes	As the research team visited retailer websites, documented what information was available to the consumer regarding the energy efficiency of the unit.
Sources	Sears Website; Best Buy Website, Home Depot Website, Lowe's Website, Staples Website; Walmart Website; Target Website; Costco Website; Walgreens Website; ENERGY STAR 2015.
Comments	The team found that ENERGY STAR designation was not always available to the consumer and that the efficiency metric (CADR/Watt [dust]) was never available.  The team also found there is substantial variation in the efficiency metric (CADR/Watt [dust]) for ENERGY STAR certified room air cleaners, making it unclear what a "good" score would be.

**Table 2-40: RSW Market Indicator Details: Energy Savings**

Definition	Estimated savings associated with efficient measures
Data collection method	Secondary
Data collection notes	
Sources	The team used an estimate provided by ENERGY STAR to Research Into Action in 2014.
Comments	

**Table 2-41: RSW Market Indicator Details: Penetration and Shipments**

Definition	The quantity of ENERGY STAR shipments and estimated market penetration for any type of air cleaner.
Data collection method	Secondary
Data collection notes	The research team visited the ENERGY STAR website to retrieve information on shipments of ENERGY STAR air cleaners in the United States for years 2011-2013.  The estimates of market penetration for any air cleaner came from reports found on the California Energy Commission Website, including a report by AHAM.
Sources	ENERGY STAR Website 2014, 2013, 2012; California Energy Commission Website 2004; Association of Home Appliance Manufacturers (AHAM) 2004.

Comments
----------

**Table 2-42: RSW Market Indicator Details: Existing Program Information**

Definition	Existing programs incentivizing the purchase of an ENERGY STAR Air Cleaner
Data collection method	Secondary
Data collection notes	The team located a report by the Consortium for Energy Efficiency that provided an overview of residential appliance rebate programs. From this report, the team extracted information on programs that offered rebates for the purchase of an ENERGY STAR certified room air cleaner
Sources	Consortium for Energy Efficiency (CEE) 2014.
Comments	

### 2.4.5. Water Heaters

**Table 2-43: RSW Market Indicator Details: Work Paper Parameters**

Definition	Summary of IOU work paper measure parameters including base case and measure EF, effective useful life, measure cost data, energy use and savings data.
Data collection method	Secondary
Data collection notes	Since IOU work paper updates are in progress to incorporate the 2015 code and specification changes, this data also includes the DEER database updated water heater savings measures. This savings data is presented alongside the national DOE savings estimates
Sources	PG&E, 2014; SCE, 2014; SCG, 2014; SDG&E, 2014; DEER
Comments	

**Table 2-44: RSW Market Indicator Details: Retail Availability and Assortment**

Definition	Measure retail availability online and in-store, and number of models available.
Data collection method	Secondary
Data collection notes	Most data comes from a 2014 PG&E sponsored study.
Sources	ACEEE, 2012a; Research Into Action, Inc., 2014; PG&E, 2012
Comments	

**Table 2-45: RSW Market Indicator Details: Household Penetration**

Definition	Percentage of homes with each type of water heater, by IOU territory and statewide.
Data collection method	Secondary

Data collection notes	Not all water heater types were included in these surveys. Sample sizes were insufficient to support IOU territory-specific samples for 2012 data. 2012 CLASS survey was conducted in-home, while the 2003 and 2009 surveys were mail-in.
Sources	KEMA, 2003; KEMA, 2009; DNV-GL, 2012
Comments	

**Table 2-46: RSW Market Indicator Details: Shipments**

Definition	National shipments by water heater type.
Data collection method	Secondary
Data collection notes	
Sources	ORNL, 2011; ENERGY STAR, 2012; ENERGY STAR, 2013
Comments	

**Table 2-47: RSW Market Indicator Details: Costs**

Definition	Measure costs and installation costs.
Data collection method	Secondary
Data collection notes	Collected from various sources, both national and California-specific.
Sources	ACEEE, 2012a; Research Into Action, Inc., 2014; Itron, 2014
Comments	

**Table 2-48: RSW Market Indicator Details: Energy Savings**

Definition	Estimated unit energy consumption and unit energy savings for each measure, pre- and post- 2015 federal standards and ENERGY STAR specification update.
Data collection method	Secondary
Data collection notes	Provided both national level and California-specific deemed savings estimates.
Sources	DEER, 2015; ACEEE, 2012b; DOE, 2009; NEEA 2015
Comments	NEEA test protocol uses different measure definitions – UEC and UES values are approximate, and ranges are provided where RSW measures span multiple NEEA efficiency bins.

**Table 2-49: RSW Market Indicator Details: Codes and Specifications**

Definition	A list of historical and current federal and state mandatory codes and voluntary specifications.
Data collection method	Secondary



Data collection notes	Note that the most recent codes are separated based on tank size for several product types.
Sources	DOE, 2010; DOE, 2009; ENERGY STAR (various)
Comments	

---

## 2.5. Sources

The lists below present all the sources from which the project team drew RSW II data.

### 2.5.1. Advanced Power Strips

Amazon Website. <http://www.amazon.com>. Accessed 11/15/2014

American Council for an Energy-Efficient Economy. 2014a. Accelerating Adoption of Advanced Plug Load Management Devices. <http://aceee.org/files/proceedings/2014/data/papers/9-862.pdf>.

American Council for an Energy-Efficient Economy. 2014b. Attacking Plug Loads: A Campaign to Deploy Automated Plug Strip Controllers. <http://aceee.org/files/proceedings/2014/data/papers/9-397.pdf>.

Apple Website. <http://www.apple.com>. Accessed 11/15/2014

Best Buy Website. <http://www.bestbuy.com>. Accessed 11/15/2014

CDW Website. <https://www.cdw.com>. Accessed 11/15/2014

Consortium for Energy Efficiency. 2013. Consumer Electronics Program Summary. [http://library.cee1.org/sites/default/files/library/10819/CEE\\_ConsumerElectronics\\_ProgramSummary\\_Aug2013.xlsx](http://library.cee1.org/sites/default/files/library/10819/CEE_ConsumerElectronics_ProgramSummary_Aug2013.xlsx).

Corning. 2013. "TV Replacement Cycle". [http://www.corning.com/news\\_center/features/TV\\_replacement\\_cycle.aspx](http://www.corning.com/news_center/features/TV_replacement_cycle.aspx)

Costco Website. <http://www.costco.com>. Accessed 11/15/2014

CVS Website. <http://www.cvs.com>. Accessed 11/15/2014

Dealscope. 2013. The Top 101 Consumer Electronics Retailers. <http://www.dealscope.com/common/items/biz/ds/pdf/2013/03/top101.pdf>. Accessed 11/15/2014

Dell Website. <http://www.dell.com>. Accessed 11/15/2014

Display Central. 2012. "Bring Out Your Dead! – What's Your TV Replacement Rate?". <http://www.display-central.com/free-news/display-daily/bring-out-your-dead-whats-your-tv-replacement-rate/>

- DNV-GL. 2012. California Lighting and Appliance Saturation Survey (CLASS).  
<https://websafe.kemainc.com/projects62/Default.aspx?tabid=190>
- ECOS Consulting. 2005. Smart Plug Strips: Draft Report.  
<http://www.efficientproducts.org/reports/smartplugstrip/Ecos-Smart-Plug-Strips-DRAFT-Jul2009-v2x.pdf>.
- Energy and Resource Solutions. 2013. Emerging Technologies Research Report.  
[http://www.neep.org/sites/default/files/resources/NEEP\\_EMV\\_EmergingTechResearch\\_Report\\_Final.pdf](http://www.neep.org/sites/default/files/resources/NEEP_EMV_EmergingTechResearch_Report_Final.pdf).
- Energy Federation, Inc. 2014. EFI.org/store.  
<http://www.energyfederation.org/consumer/default.php>. Accessed 11/26/2014
- Esource. 2014. Advanced Power Strips in Residential Settings – Data Sheets.  
<http://www.esource.com/members/DSM-F-2a/Focus-Report/APS-Measure-Profile-Data-Sheets.xls>
- Fraunhofer. 2012. Home Energy Management: Products and Trends.  
<http://cse.fraunhofer.org/Portals/55819/docs/hem-products-practices-CEEindustry-partners.pdf>.
- GameStop Website. <http://www.gamestop.com>. Accessed 11/15/2014
- Home Depot Website. <http://www.homedepot.com>. Accessed 11/15/2014
- HP Website. <http://www.hp.com/country/us/en/uc/welcome.html>. Accessed 11/15/2014
- Kroger Website. <https://www.kroger.com>. Accessed 11/15/2014
- Leichtman Research Group. 2014. "Television's Changing Face".  
[http://www.leichtmanresearch.com/research/notes03\\_2014.pdf](http://www.leichtmanresearch.com/research/notes03_2014.pdf)
- National Renewable Energy Laboratory. 2012. Results of Laboratory Testing of Advanced Power Strips.  
[http://apps1.eere.energy.gov/buildings/publications/pdfs/building\\_america/advanced\\_power\\_strips.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/advanced_power_strips.pdf).
- National Retail Federation. 2013. Top 100 Retailers Chart, 2014. <https://nrf.com/2014/top100-table>. Accessed 11/15/2014
- Navigant Consulting, Inc. 2014. 2013 California Energy Efficiency Potential and Goals Study.  
<http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Energy+Efficiency+Goals+and+Potential+Studies.htm>.
- New York State Energy Research and Development Authority. 2011. Advanced Power Strip Research Report. <http://www.nyserda.ny.gov/-/media/Files/EERP/Residential/Energy-Efficient-and-ENERGY-STAR-Products/Power-Management-Research-Report.pdf>.

- NMR Consulting, Inc. 2012. Massachusetts Residential Retail Products: Consumer Electronics Saturation. [http://ma-eeac.org/wordpress/wp-content/uploads/Massachusetts-Residential-Retail-Products\\_Consumer-Electronics-Saturation.pdf](http://ma-eeac.org/wordpress/wp-content/uploads/Massachusetts-Residential-Retail-Products_Consumer-Electronics-Saturation.pdf).
- Northwest Energy Efficiency Partnerships. 2011. Advanced Power Strips: Energy Efficiency through Plug Loads. [http://aceee.org/files/pdf/conferences/eer/2011/BS3E\\_Malik.Rasmussen.pdf](http://aceee.org/files/pdf/conferences/eer/2011/BS3E_Malik.Rasmussen.pdf).
- Northwest Energy Efficiency Partnerships. 2013. Advanced Power Strips Test Protocol. [http://www.neep.org/sites/default/files/resources/Report\\_APSTestingProtocolFINAL.pdf](http://www.neep.org/sites/default/files/resources/Report_APSTestingProtocolFINAL.pdf).
- Northwest Energy Efficiency Partnerships. 2014. Advanced Power Strip Common Terminology. <http://50.63.66.116/Assets/uploads/files/market-strategies/BCE/APSCCommonTerminology.pdf>.
- Northwest Regional Technical Forum. 2013. Advanced Power Strips Planning Workbook v1.5. [http://rtf.nwcouncil.org/measures/res/ResAdvancedPowerStrips\\_v1\\_5.xlsm](http://rtf.nwcouncil.org/measures/res/ResAdvancedPowerStrips_v1_5.xlsm).
- PG&E. 2015. PG&E "Company Profile" . <http://www.pge.com/en/about/company/profile/index.page>
- Research Into Action, Inc. 2010. Electronics and Energy Efficiency: A Plug Load Characterization Study. [http://www.calmac.org/publications/bce\\_final.pdf](http://www.calmac.org/publications/bce_final.pdf).
- Safeway Website. <http://www.safeway.com>. Accessed 11/15/2014
- San Diego Gas and Electric. 2014. Smart Power Strips Work Paper WPSDGEREHE0003.
- SCE. 2014. Smart Power Strips Work Paper SCE13CS002 R2.
- SCE. 2015. SCE "Who We Are". [https://www.sce.com/wps/portal/home/about-us/who-we-are!/ut/p/b1/rVRdb4IwFP0re\\_Gx9mLL1yNGg7jpYtQofSEFCrIJVUTZ9usHzmTbg6CJfWh6k3tPzjk9LWZ4jVnGT0nMi0RmfFvXTPMUw7ZGzhwce0FVcPo9ndh9hyyGatXgVg1wZVlwnjdtGI7Gr\\_X8jIBDZjCdWxYB0PAKM8yCrNgVG-weAuEFMitEVngi68DI3AHuy2PxdDx0oNxIVArEc1EP7oIkxK4ehRQoEBRpvkDU0BXE1cCstlDlmjD8MDIuRBuYNAgdUHqZb2hoMeostMWqNrPGmMVb6Vf3supjpgxfBjOrJmZlPjFizHIRiVzk3Y08FHhldmU3ljLeim4gU-xWAvSrAp5VPP91lAdENQPuo54uNET9EBCvzEWmMEwqQpVyiNoA4dGAvbsBxzdcavK23zOrymCdtY\\_KttYQNvNcKPQvz5uy2Qy4VB4NSO4GHN\\_wD9zv5L\\_nvEuXqUE-E\\_QeTRLytYjS1JtOefPV3emnmhy-AYOau\\_0!/dl4/d5/L2dBISEvZ0FBIS9nQSEh/](https://www.sce.com/wps/portal/home/about-us/who-we-are!/ut/p/b1/rVRdb4IwFP0re_Gx9mLL1yNGg7jpYtQofSEFCrIJVUTZ9usHzmTbg6CJfWh6k3tPzjk9LWZ4jVnGT0nMi0RmfFvXTPMUw7ZGzhwce0FVcPo9ndh9hyyGatXgVg1wZVlwnjdtGI7Gr_X8jIBDZjCdWxYB0PAKM8yCrNgVG-weAuEFMitEVngi68DI3AHuy2PxdDx0oNxIVArEc1EP7oIkxK4ehRQoEBRpvkDU0BXE1cCstlDlmjD8MDIuRBuYNAgdUHqZb2hoMeostMWqNrPGmMVb6Vf3supjpgxfBjOrJmZlPjFizHIRiVzk3Y08FHhldmU3ljLeim4gU-xWAvSrAp5VPP91lAdENQPuo54uNET9EBCvzEWmMEwqQpVyiNoA4dGAvbsBxzdcavK23zOrymCdtY_KttYQNvNcKPQvz5uy2Qy4VB4NSO4GHN_wD9zv5L_nvEuXqUE-E_QeTRLytYjS1JtOefPV3emnmhy-AYOau_0!/dl4/d5/L2dBISEvZ0FBIS9nQSEh/)
- SDG&E. 2015. SDG&E "About Us". <http://www.sdge.com/aboutus>
- Staples Website. <http://www.staples.com>. Accessed 11/15/2014
- Target Website. <http://www.target.com>. Accessed 11/15/2014
- U.S. Census. 2011. "Census Bureau Releases 2010 Census Demographic Profiles for Alaska, Arizona, California, Connecticut, Georgia, Idaho, Minnesota, Montana, New Hampshire,

New York, Ohio, Puerto Rico and Wisconsin".

[http://www.census.gov/newsroom/releases/archives/2010\\_census/cb11-cn137.html](http://www.census.gov/newsroom/releases/archives/2010_census/cb11-cn137.html)

U.S. Census. 2014. U.S. Census State and County QuickFacts.

<http://quickfacts.census.gov/qfd/states/06000.html>

Walgreens Website. <http://www.walgreens.com>. Accessed 11/15/2014

Walmart Website. <http://www.walmart.com>. Accessed 11/15/2014

## 2.5.2. Clothes Dryers

ACEEE, Ecova. 2014. The Time is Ripe for Paying Attention to Clothes Drying Technology and Policy in Relation to Efficiency and Drying Time.

<http://www.aceee.org/files/proceedings/2014/data/index.htm>. Accessed 10/15/2014

ACEEE, Navigant. 2010. Estimating the Remaining Useful Life of Residential Appliances.

<http://aceee.org/files/proceedings/2010/data/papers/1977.pdf>. Accessed 10/7/2014

ACEEE, NEEA, Ecova. 2014. Clothes Dryer Testing: Testy Testing Makes for Better

Transformation. <http://www.aceee.org/files/proceedings/2014/data/index.htm>. Accessed 10/16/2014

ACEEE, Vermont Energy Investment Corporation. 2014. A New Model for Emerging Technologies: A Case Study of the Super Efficient Dryers Initiative.

<http://www.aceee.org/files/proceedings/2014/data/index.htm>. Accessed 10/17/2014

CLASS. 2012. California Lighting and Appliance Saturation Study.

[https://websafe.kemainc.com/susc/CPUC\\_CLASS\\_2012/SUSc\\_CPUC\\_CLASS\\_2012.aspx](https://websafe.kemainc.com/susc/CPUC_CLASS_2012/SUSc_CPUC_CLASS_2012.aspx). Accessed 12/15/2014

CNET. 2013. Dryer Buying Guides. <http://www.cnet.com/topics/dryers/buying-guide/>. Accessed 10/14/2014

DOE. 2014. Residential Clothes Dryers Standards.

[http://www1.eere.energy.gov/buildings/appliance\\_standards/product.aspx/productid/36#standards](http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/36#standards). Accessed 10/14/2014

DOE/EERE. 2011. Technical Support Document: Chapter 7 Energy Use.

<http://www.regulations.gov/#!documentDetail;D=EERE-2007-BT-STD-0010-0053>. Accessed 10/14/2014

DOE/EERE. 2011. Technical Support Document: Chapter 9 Shipment analysis.

<http://www.regulations.gov/#!documentDetail;D=EERE-2007-BT-STD-0010-0053>. Accessed 10/7/2014

Ecova, CLASP, SEDI. 2013. Analysis of Potential Energy Savings from Heat Pump Clothes Dryers in North America.

<http://www.clasponline.org/en/Resources/Resources/PublicationLibrary/2013/Clothes->

Dryer-Heat-Pump-Technology-Offers-Substantial-Cost-and-Energy-Savings-for-North-America.aspx. Accessed 10/18/2014

ENERGY STAR. 2011. ENERGY STAR Market & Industry Scoping Report Residential Clothes Dryers November 2011.  
[http://www.energystar.gov/ia/products/downloads/ENERGY\\_STAR\\_Scoping\\_Report\\_Residential\\_Clothes\\_Dryers.pdf](http://www.energystar.gov/ia/products/downloads/ENERGY_STAR_Scoping_Report_Residential_Clothes_Dryers.pdf). Accessed 10/14/2014

ENERGY STAR. 2013. 2013 Emerging Technology Award: Advanced Clothes Dryers.  
<http://www.energystar.gov/about/awards/awards-archive/2013-emerging-technology-award-advanced-clothes-dryers>. Accessed 10/14/2014

ENERGY STAR. 2014. 2014 Emerging Technology Award Winning Dryers.  
<http://www.energystar.gov/sites/default/files/asset/document/2014%20Emerging%20Technology%20Award%20Advanced%20Clothes%20Dryer%20Models%20093014.pdf>. Accessed 10/14/2014

ENERGY STAR. 2014. 2014 Emerging Technology Award: Advanced Clothes Dryers.  
<http://www.energystar.gov/about/awards/energy-star-emerging-technology-award/2014-emerging-technology-award-advanced-clothes-dryers>. Accessed 10/14/2014

ENERGY STAR. 2014. Clothes Dryers Key Product Criteria.  
[https://www.energystar.gov/index.cfm?c=clothesdry.pr\\_crit\\_clothes\\_dryers](https://www.energystar.gov/index.cfm?c=clothesdry.pr_crit_clothes_dryers). Accessed 10/6/2014

Energy Star. 2014. ENERGY STAR rebate finder. [http://www.energystar.gov/rebate-finder?scrollTo=0&search\\_text=&sort\\_by=utility&sort\\_direction=asc&zip\\_code\\_filter=&product\\_clean\\_filter=Clothes+Dryers&product\\_clean\\_isopen=&page\\_number=0&lastpage=0](http://www.energystar.gov/rebate-finder?scrollTo=0&search_text=&sort_by=utility&sort_direction=asc&zip_code_filter=&product_clean_filter=Clothes+Dryers&product_clean_isopen=&page_number=0&lastpage=0). Accessed 12/15/2014

Energy Star. 2014. ENERGY STAR Program Requirements Product Specification for Clothes Dryers. <http://www.energystar.gov/sites/default/files/specs//ENERGY%20STAR%20Final%20Version%201%2000%20Clothes%20Dryers%20Program%20Requirements.pdf>. Accessed 10/14/2014

ENERGY STAR. 2014. Product finder - Certified Residential Clothes Dryers.  
<https://www.energystar.gov/productfinder/product/certified-clothes-dryers/>. Accessed 10/7/2014

ENERGY STAR. 2014. Product Finder - LG - DLHX4072.  
<https://www.energystar.gov/productfinder/product/certified-clothes-dryers/details/2216729>. Accessed 10/14/2014

ENERGY STAR. 2013. ENERGY STAR Draft 2 Version 1.0 Clothes Dryer Data and Analysis.  
<https://www.energystar.gov/sites/default/files/specs//ENERGY%20STAR%20Draft%20%20Version%201.0%20Clothes%20Dryers%20Data%20and%20Analysis.xlsx>

Home Depot Website. [www.homedepot.com](http://www.homedepot.com). Accessed 10/14/2014

- Home Guides. 2014. The Average Life of a Front-Loading Dryer. <http://homeguides.sfgate.com/average-life-frontloading-dryer-102084.html>. Accessed 10/14/2014
- LBNL. 2011. Max Tech and Beyond: Cumulative (30-year) Technical Energy-Savings Potential Estimates. [http://cltc.ucdavis.edu/sites/default/files/files/publication/2011\\_lbnl\\_max\\_tech\\_beyond.pdf](http://cltc.ucdavis.edu/sites/default/files/files/publication/2011_lbnl_max_tech_beyond.pdf). Accessed 6/5/2015.
- Lowes Website. [www.lowes.com](http://www.lowes.com). Accessed 10/14/2014
- NRDC. 2011. Residential Clothes Dryers: A Closer Look at Energy Efficiency Test Procedures and Savings Opportunities. [http://docs.nrdc.org/energy/files/ene\\_14060901a.pdf](http://docs.nrdc.org/energy/files/ene_14060901a.pdf). Accessed 10/14/2014
- RASS. 2009. California Statewide Residential Appliance Saturation Study. <https://websafe.kemainc.com/RASS2009/Query.aspx?QType=1&tabid=1>. Accessed 12/15/2014
- Research Into Action. 2012. Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE) . [http://www.calmac.org/publications/HEER\\_\\_BCE\\_083012\\_FINAL.pdf](http://www.calmac.org/publications/HEER__BCE_083012_FINAL.pdf). Accessed 10/7/2014
- Research Into Action. 2014. Key MT Characteristics of Devices and Final Prioritization. U:\P324 PG&E Work Paper Consulting\01 Task 1 10 Devices from RSW\Final Deliverables\Work Paper Update Task 1 MT Prioritization Device Summary Spreadsheet 20140829.xlsx. Accessed 10/14/2014
- Sears Website. [www.sears.com](http://www.sears.com). Accessed 10/14/2014

### 2.5.3. Pool Pumps

- Amazon Website. <http://www.amazon.com>. Accessed 11/3/2014
- The Association of Pool and Spa Professionals. 2014. Energy Efficient Pool Pumps. <http://apsp.org/resources/energy-efficient-pool-pumps.aspx>. Accessed 10/15/14.
- The Association of Pool and Spa Professionals. 2012. US Swimming Pool and Hot Tub Market 2012. [http://www.energy.ca.gov/appliances/2013rulemaking/documents/responses/Residential\\_Pool\\_Pumps\\_and\\_Replacement\\_Motors\\_12-AAER-2F/California\\_IOUs\\_Response\\_to\\_the\\_Invitation\\_to\\_Participate\\_for\\_Residential\\_Pool\\_Pumps\\_and\\_Motors\\_REFERENCES/PKData\\_2012\\_US\\_Swimming\\_Pool\\_and\\_Hot\\_Tub\\_Market.pdf](http://www.energy.ca.gov/appliances/2013rulemaking/documents/responses/Residential_Pool_Pumps_and_Replacement_Motors_12-AAER-2F/California_IOUs_Response_to_the_Invitation_to_Participate_for_Residential_Pool_Pumps_and_Motors_REFERENCES/PKData_2012_US_Swimming_Pool_and_Hot_Tub_Market.pdf). Accessed 11/25/14.
- BestBuy Pool Supplies. 2014. <http://www.bestbuypoolsupply.com>. Accessed 11/3/14.
- California Public Utilities Commission. 2010. Residential Retrofit – High Impact Measure Evaluation Report. <http://www.calmac.org/results.asp?t=2>. Accessed 11/24/14.

- California Energy Commission. 2013. California IOUs response to the Invitation to Submit Proposals for Pool and Spas.  
[http://www.energy.ca.gov/appliances/2013rulemaking/documents/proposals/12-AAER-2F\\_Residential\\_Pool\\_Pumps\\_and\\_Replacement\\_Motors/California\\_IOUs\\_Response\\_to\\_the\\_Invitation\\_to\\_Submit\\_Proposals\\_for\\_Pool\\_and\\_Spas\\_2013-07-29\\_TN-71756.pdf](http://www.energy.ca.gov/appliances/2013rulemaking/documents/proposals/12-AAER-2F_Residential_Pool_Pumps_and_Replacement_Motors/California_IOUs_Response_to_the_Invitation_to_Submit_Proposals_for_Pool_and_Spas_2013-07-29_TN-71756.pdf). Accessed 1/13/15.
- Consortium for Energy Efficiency. 2014. 2014 Overview of Residential Swimming Pool Programs in the United States and Canada. <http://library.cee1.org/content/2014-overview-residential-swimming-pool-programs/>. Accessed on 10/7/14.
- Consortium for Energy Efficiency. 2014. CEE Dives into Swimming Pools.  
<http://www.cee1.org/content/cee-dives-swimming-pools>
- Consortium for Energy Efficiency. 2014. CEE High Efficiency Residential Swimming Pool Initiative.
- Energy Star. Savings Calculator for ENERGY STAR Certified Inground Pool Pumps. Accessed 10/7/2014.
- Energy Star. Energy Star Certified Pool Pumps.  
<http://www.energystar.gov/productfinder/product/certified-pool-pumps/results>. Accessed 11/3/14.
- Energy Star. 2014. Have Fun in the Sun and Save: Choose Energy Star Certified Pool Pumps.  
[https://www.energystar.gov/sites/default/files/asset/document/ES%20pool%20pump%20factsheet\\_080514\\_v5\\_0.pdf](https://www.energystar.gov/sites/default/files/asset/document/ES%20pool%20pump%20factsheet_080514_v5_0.pdf). Accessed 11/24/14.
- Gulf Power. Earth Cents Pool Pumps. <http://www.gulfpower.com/residential/earthcents/pool-pump.cshtml>. Accessed 11/3/14
- Homewyse. 2014. Cost to Replace a Pool Pump.  
[http://www.homewyse.com/services/cost\\_to\\_replace\\_pool\\_pump.html](http://www.homewyse.com/services/cost_to_replace_pool_pump.html). Accessed 11/3/14.
- Leslie's Pool Supplies. [www.leslies.com](http://www.leslies.com). Accessed 10/7/14.
- Navigant Consulting, Inc. 2014. 2013 California Energy Efficiency Potential and Goals Study.  
<http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M088/K661/88661468.PDF> and 2013 Potential and Goals Model [ftp://ftp.cpuc.ca.gov/gopher-data/energy\\_division/EnergyEfficiency/CA\\_PGT\\_Model\\_2013%20Final%20Model%20Release.zip](ftp://ftp.cpuc.ca.gov/gopher-data/energy_division/EnergyEfficiency/CA_PGT_Model_2013%20Final%20Model%20Release.zip).
- Pacific Gas and Electric. 2014. Variable Speed Pool Pump Rebates Database.  
<http://www.pge.com/includes/jsp/csvdb/rebatehandler.jsp>. Accessed 10/14/14.
- Pacific Gas and Electric. 2012. Work Paper PGECOPUM102 Residential Variable Speed Pool Pump Revision #4. (Measure Code P107 and P108).

- Pacific Gas and Electric. 2010. Process Evaluation of 2006-2008 PG&E Mass Markets Program Portfolio and CFL, Swimming Pool Market Characterizations. <http://www.calmac.org/results.asp?t=2>. Accessed 11/24/14.
- Pacific Gas and Electric. 2015. <http://www.pge.com/en/about/company/profile/index.page>. Accessed 1/13/15.
- Pool Plaza. [http://www.poolplaza.com/pool-school/pool\\_pump\\_curves.shtml](http://www.poolplaza.com/pool-school/pool_pump_curves.shtml). Accessed 10/7/14.
- Poolsupplies.com. 2014. Pool pumps. <http://www.poolsupplies.com/shop/equipment/pumps-motors/pool-pumps>. Accessed 10/14/14.
- Professional Poolcare. Florida Energy Efficient Swimming Pool Pump Law Explained. <http://professionalpoolcareorlando.com/pump-repairs/florida-energy-efficient-swimming-pool-pump-law-explained/>. Accessed 11/3/14.
- San Diego Gas and Electric. 2014. Pool pump and motor rebates. <http://www.sdge.com/rebates-finder/pool-pump-and-motor-rebates>. Accessed 10/14/14.
- San Diego Gas and Electric. 2015. [http://en.wikipedia.org/wiki/San\\_Diego\\_Gas\\_%26\\_Electric](http://en.wikipedia.org/wiki/San_Diego_Gas_%26_Electric). Accessed 1/13/15.
- Southern California Edison. 2014. Rebates and incentives: Efficiency has its Perks [https://www.sce.com/wps/portal/home/residential/rebates-savings/rebates!/ut/p/b1/hc\\_BCoJAFAXQb\\_ED8j0dHHU5gulIJKaVzSY0bBLUCRP9\\_RTcRXV3F86Dd0FADqIrxloWQ626olm6oFfDCVjIU-SBbzHkHrqZtaPkaNMZXGaAX8Lw3\\_0ZxC-SGOQDHGwTeXTyd7FnmOiYK3AD9MMonkGWEOQkwX3KGEGkK\\_jxZARCNqqcB589EHuHjp1cprGuJI4E0Vf3qq96\\_aFeA-TTN0lSKdlU-k218GxztPIGbKWmvQFBoxSt/dl4/d5/L2dBISEvZ0FBIS9nQSEh/?from=residential/rebates-savings](https://www.sce.com/wps/portal/home/residential/rebates-savings/rebates!/ut/p/b1/hc_BCoJAFAXQb_ED8j0dHHU5gulIJKaVzSY0bBLUCRP9_RTcRXV3F86Dd0FADqIrxloWQ626olm6oFfDCVjIU-SBbzHkHrqZtaPkaNMZXGaAX8Lw3_0ZxC-SGOQDHGwTeXTyd7FnmOiYK3AD9MMonkGWEOQkwX3KGEGkK_jxZARCNqqcB589EHuHjp1cprGuJI4E0Vf3qq96_aFeA-TTN0lSKdlU-k218GxztPIGbKWmvQFBoxSt/dl4/d5/L2dBISEvZ0FBIS9nQSEh/?from=residential/rebates-savings). Accessed 10/14/14.
- Southern California Edison. 2015. [http://en.wikipedia.org/wiki/Southern\\_California\\_Edison](http://en.wikipedia.org/wiki/Southern_California_Edison). Accessed 1/13/15.
- Southern California Edison. 2012. Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) /Business & Consumer Electronics (BCE) Study # SCE0306. <http://www.calmac.org/results.asp?t=2>. Accessed 10/7/14.
- U.S. Census Bureau. 2015. U.S. Census Bureau: Quick Facts: California. <http://quickfacts.census.gov/qfd/states/06000.html>. Accessed 1/13/15.

### 2.5.4. Air Cleaners

- Association of Home Appliance Manufacturers (AHAM). 2004. Report to California Energy Commission Analysis of Energy Efficiency of Room Air Cleaners. [http://www.energy.ca.gov/appliances/2003rulemaking/documents/public\\_comments/2004-8-13\\_AHAM.PDF](http://www.energy.ca.gov/appliances/2003rulemaking/documents/public_comments/2004-8-13_AHAM.PDF)



Best Buy Website. <http://www.bestbuy.com>. Accessed 1/30/2015

California Energy Commission Website. 2004. Codes and Standards Enhancement Initiative For PY2004: Title 20 Standards Development - Draft Analysis of Standards Options For Portable Room Air Cleaners.  
[http://www.energy.ca.gov/appliances/2003rulemaking/documents/case\\_studies/CASE\\_Port\\_Room\\_Air\\_Cleaner.pdf](http://www.energy.ca.gov/appliances/2003rulemaking/documents/case_studies/CASE_Port_Room_Air_Cleaner.pdf)

Consortium for Energy Efficiency. 2014. Overview of Residential Appliance Programs in the United States and Canada.  
<http://library.cee1.org/sites/default/files/library/11671/2014CEEResAppliancesProgramOverview.pdf>

Costco Website. <http://www.costco.com>. Accessed 1/30/2015

Energy Solutions. 2015. NEEA Air Cleaner ENERGY STAR Market Penetration Estimate. Personal Correspondence.

ENERGY STAR Website. 2015. ENERGY STAR Certified Room Air Cleaners  
<http://www.energystar.gov/productfinder/product/certified-room-air-cleaners/results>. Accessed 2/17/2015

ENERGY STAR Website. 2014. ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2013 Summary.  
[https://www.energystar.gov/ia/partners/downloads/unit\\_shipment\\_data/2013\\_USD\\_Summary\\_Report.pdf?df30-e6f6](https://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2013_USD_Summary_Report.pdf?df30-e6f6)

ENERGY STAR Website. 2013. ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2012 Summary.  
[http://www.energystar.gov/ia/partners/downloads/unit\\_shipment\\_data/2012\\_USD\\_Summary\\_Report.pdf](http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2012_USD_Summary_Report.pdf)

ENERGY STAR Website. 2012. ENERGY STAR® Unit Shipment and Market Penetration Report Calendar Year 2011 Summary.  
[http://www.energystar.gov/ia/partners/downloads/unit\\_shipment\\_data/2011\\_USD\\_Summary\\_Report.pdf](http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2011_USD_Summary_Report.pdf)

ENERGY STAR Website. 2011. ENERGY STAR Program Requirements: Product Specification for Room Air Cleaners - Eligibility Criteria Version 1.2  
[http://www.energystar.gov/sites/default/files/specs//private/Room\\_Air\\_Cleaners\\_Final\\_V1.2\\_Specification.pdf](http://www.energystar.gov/sites/default/files/specs//private/Room_Air_Cleaners_Final_V1.2_Specification.pdf)

Home Depot Website. <http://www.homedepot.com>. Accessed 1/30/2015

Kema. 2009. California Statewide Residential Appliance Saturation Study (RASS).  
<https://websafe.kemainc.com/RASS2009/Query.aspx?QType=1&tabid=1>. Accessed 2/17/2015

Lowe's Website. <http://www.lowes.com>. Accessed 1/30/2015

Sears Website. <http://www.sears.com>. Accessed 1/30/2015

Staples Website. <http://www.staples.com>. Accessed 1/30/2015

Target Website. <http://www.target.com>. Accessed 1/30/2015

Walgreens Website. <http://www.walgreens.com>. Accessed 1/30/2015

Walmart Website. <http://www.walmart.com>. Accessed 1/30/2015

Wall Street Journal. 2014. Sears Crucial Appliance Sales Erode.  
<http://www.wsj.com/articles/SB10001424127887323665504579028371672070930>

### 2.5.5. Water Heaters

American Council for an Energy-Efficient Economy (ACEEE). 2008. Water Heater Marketplace. [https://www.aceee.org/files/pdf/conferences/hwf/2008/plen2\\_parker.pdf](https://www.aceee.org/files/pdf/conferences/hwf/2008/plen2_parker.pdf)

American Council for an Energy-Efficient Economy (ACEEE). 2010. Heat Pump Water Heaters and American Homes: A Good Fit? .  
<http://www.aceee.org/files/proceedings/2010/data/papers/2205.pdf>

American Council for an Energy-Efficient Economy (ACEEE). 2012a. Emerging Hot Water Technologies and Practices for Energy Efficiency as of 2011.  
[http://cloud.cdhenenergy.com/dhw\\_coe/documents/reports/aceee\\_final\\_a112.pdf](http://cloud.cdhenenergy.com/dhw_coe/documents/reports/aceee_final_a112.pdf)

American Council for an Energy-Efficient Economy (ACEEE). 2012b. Market Transformation Efforts for Water Heating Efficiency.  
<http://www.aceee.org/sites/default/files/publications/researchreports/a121.pdf>

American Council for an Energy-Efficient Economy (ACEEE). The Opportunity for Gas-Fired Heat Pump Water Heaters. <http://aceee.org/files/pdf/conferences/hwf/2013/6A-glanville.pdf>

Center for Energy and Environment. 2010. Actual Savings and Performance of Natural Gas Tankless Water Heaters. <http://www.mncee.org/getattachment/7b8982e9-4d95-4bc9-8e64-f89033617f37/>

CenterPoint Energy. 2013. Energy Efficiency Program Portfolio Annual Report 2013 Program Year. <http://www.apscservices.info/EEInfo/EEReports/CenterPoint%202013.pdf>

Consortium for Energy Efficiency (CEE). 2008. High-Efficiency Residential Gas Water Heating Initiative.  
[http://library.cee1.org/sites/default/files/library/7520/CEE\\_WH\\_Initiative\\_Description\\_3-27-2008.pdf](http://library.cee1.org/sites/default/files/library/7520/CEE_WH_Initiative_Description_3-27-2008.pdf)

Consortium for Energy Efficiency (CEE). 2014 CEE Residential Water Heating Program Summary.  
[http://library.cee1.org/sites/default/files/library/11971/CEE\\_ResWaterHeating\\_2014ProgramSummary\\_12-22-14.xlsx](http://library.cee1.org/sites/default/files/library/11971/CEE_ResWaterHeating_2014ProgramSummary_12-22-14.xlsx)

- CUSCST. 2011. 2013 California Building Efficiency Standards: High Efficiency Water Heater Ready.  
[http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Residential/Water\\_Heating/2013\\_CASE\\_WH2.WH5\\_WaterHeaterReady-10.28.2011.pdf](http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Residential/Water_Heating/2013_CASE_WH2.WH5_WaterHeaterReady-10.28.2011.pdf)
- DEER. 2015. DEER 2011 Database Tool To View and Download Data.  
<http://www.deeresources.com/index.php/deer-versions/deer2011-for-13-14>
- Department of Energy. 2009. Water Heater Technical Support Document. Chapter 7: Energy Use Characterization. <http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0129-0170>
- Department of Energy. 2010. Energy Conservation Program: Energy Conservation Standards for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters; Final Rule.  
<http://www.regulations.gov/contentStreamer?objectId=0900006480ad8951&disposition=attachment&contentType=pdf>
- DNV GL. 2012. California Lighting and Appliance Saturation Survey (CLASS).  
<https://websafe.kemainc.com/projects62/Default.aspx?tabid=190>
- ENERGY STAR. 2007. Residential Water Heaters: Draft Criteria Analysis.  
[http://www.energystar.gov/ia/partners/prod\\_development/new\\_specs/downloads/water\\_heaters/WaterHeaterDraftCriteriaAnalysis.pdf](http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/WaterHeaterDraftCriteriaAnalysis.pdf)
- ENERGY STAR. 2008. Residential Water Heaters: Draft Criteria Analysis.  
[https://www.energystar.gov/ia/partners/prod\\_development/new\\_specs/downloads/water\\_heaters/WaterHeaterAnalysis\\_Final.pdf](https://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/WaterHeaterAnalysis_Final.pdf)
- ENERGY STAR. 2009. ENERGY STAR® Program Requirements for Residential Water Heaters v1.0.  
[http://www.energystar.gov/ia/partners/prod\\_development/new\\_specs/downloads/water\\_heaters/WaterHeater\\_ProgramRequirements.pdf?7c93-56f8](http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/WaterHeater_ProgramRequirements.pdf?7c93-56f8)
- ENERGY STAR. 2009. Program Requirements for Residential Water Heaters: Partner Commitments.  
[https://www.energystar.gov/ia/partners/product\\_specs/program\\_reqs/WaterHeater\\_ProgramRequirements.pdf](https://www.energystar.gov/ia/partners/product_specs/program_reqs/WaterHeater_ProgramRequirements.pdf)
- ENERGY STAR. 2010. Energy Star Water Heater Market Profile: Efficiency Sells.  
[http://www.energystar.gov/ia/partners/prod\\_development/new\\_specs/downloads/water\\_heaters/Water\\_Heater\\_Market\\_Profile\\_2010.pdf](http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/Water_Heater_Market_Profile_2010.pdf)
- ENERGY STAR. 2012. ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2012 Summary.  
[http://www.energystar.gov/ia/partners/downloads/unit\\_shipment\\_data/2012\\_USD\\_Summary\\_Report.pdf](http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2012_USD_Summary_Report.pdf)

- ENERGY STAR. 2012. ENERGY STAR® Program Requirements for Residential Water Heaters v2.0.  
<http://www.energystar.gov/sites/default/files/specs//ENERGY%20STAR%20Water%20Heaters%20V2%200%20Program%20Requirements.pdf>
- ENERGY STAR. 2013. ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2013 Summary.  
[http://www.energystar.gov/ia/partners/downloads/unit\\_shipment\\_data/2013\\_USD\\_Summary\\_Report.pdf](http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2013_USD_Summary_Report.pdf)
- ENERGY STAR. 2014. ENERGY STAR® Program Requirements for Residential Water Heaters v3.0.  
<http://www.energystar.gov/sites/default/files/specs//ENERGY%20STAR%20Water%20Heaters%20Version%203%200%20Program%20Requirements.pdf>
- Itron. 2014. 2010-2012 WO017 Ex Ante Measure Cost Study Final Report.  
[http://www.calmac.org/publications/2010-2012\\_WO017\\_Ex\\_Ante\\_Measure\\_Cost\\_Study\\_-\\_Final\\_Report.pdf](http://www.calmac.org/publications/2010-2012_WO017_Ex_Ante_Measure_Cost_Study_-_Final_Report.pdf)
- KEMA. 2003. 2003 California Residential Appliance Saturation Study (RASS).  
<http://websafe.kemainc.com/rass2009/Default.aspx>
- KEMA. 2009. 2009 California Residential Appliance Saturation Study (RASS).  
<http://websafe.kemainc.com/rass2009/Default.aspx>
- NEEA and PG&E. 2015. NEEA and PG&E UCEF Supplemental Test Protocol.  
<http://rtf.nwccouncil.org/meetings/2015/04/Residential%20Dryers%20v06.xlsm>
- Newport Partners LLC. 2011. Comparing Residential Water Heaters for Energy Use, Economics, and Emissions..  
<http://www.buildwithpropane.com/uploadedFiles/buildwithpropane/website/Resources/propane-water-heating-fact-sheet.pdf>
- Northwest Energy Efficiency Alliance (NEEA). 2011. 2011 Water Heater Market Update.  
<http://neea.org/docs/reports/2011waterheatermarketupdatea273dbb87ca3.pdf>
- Northwest Energy Efficiency Alliance (NEEA). 2013. 2011 Water Heater Market Update.  
<http://neea.org/docs/reports/2011waterheatermarketupdatea273dbb87ca3.pdf>
- ORNL. 2011. Research and Development Roadmap for Water Heating Technologies.  
[http://btrc.ornl.gov/pdfs/WaterHeatingTechnologiesRoadmap\\_9-30-2011\\_FINAL.pdf](http://btrc.ornl.gov/pdfs/WaterHeatingTechnologiesRoadmap_9-30-2011_FINAL.pdf)
- PG&E and SCE. 2012. Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER)/Business & Consumer Electronics (BCE)..  
[http://www.calmac.org/publications/heer\\_\\_bce\\_083012\\_final.pdf](http://www.calmac.org/publications/heer__bce_083012_final.pdf)
- PG&E. 2012. Market-Focused Program Design to Accelerate Penetration of ENERGY STAR Water Heaters. <http://www.etc->

ca.com/sites/default/files/reports/PGE%20Water%20Heater%20ET%20Final%20Report%20-%20FINAL.pdf

PG&E. 2014. Work Paper PGECODHW104 Gas Water Heater Revision # 4.

PG&E. 2014. Work Paper PGECODHW106 Electric Storage Water Heater Revision # 4.

Research Into Action. 2014. Water Heater Baseline Study- PG&E.

SCE. 2014. Work Paper SCE13WH001.2 Heat Pump Water Heater.

SCG. 2014. Workpaper WPSCGREWH140122a Tankless Water Heaters for Single family Residential Applications, Tier 2.

SDG&E. 2014. Evaluation of the San Diego Gas & Electric Plug Load and Appliances Field Services Efforts.

[http://www.calmac.org/publications/SDGE\\_Plug\\_Load\\_and\\_Appliances\\_Field\\_Services\\_Evaluation\\_Final\\_Report\\_110615\\_PDF.pdf](http://www.calmac.org/publications/SDGE_Plug_Load_and_Appliances_Field_Services_Evaluation_Final_Report_110615_PDF.pdf)

SDG&E. 2014. Work Paper WPSDGEREWH0022 Residential Heat Pump Water Heater.

### 3. Next Steps

In addition to regular updates (at least once every two years), there are several possible next steps for the Residential Solutions Workbook Phase II. The PLA team identified a number of potential data additions to consider for additional versions (Table 3-1).

**Table 3-1: RSW Phase II: Potential Additional Data**

PRODUCT	POTENTIAL ADDITIONAL DATA
ALL	Add demand savings
Air Cleaners	Incorporate information about efficiency levels above ENERGY STAR Add early retirement of single speed pumps as an opportunity. Consider new Title 20 code.
Pool Pumps	Add replacement motors as measures. Add new sales. Add multifamily data. Add small single speed pumps (<1 HP)
APS	Include commercial office savings. Research power strip supply chain: where are APS purchased, what products are they purchased with, how and when do customers purchase regular power strips?

#### *Research Platform and Hosting Considerations*

This project aligns closely not only with the RSW I, but also with several other ongoing appliance research activities the PLA team is conducting, such as the work paper update projects (some of the research from which is included in the Water Heater and APS RSW II workbooks), and other internal research efforts to align program planning and engineering research across the IOU territories. The RSW projects were purposefully designed in *Excel* to:

- › Provide a user-friendly platform that minimizes the programming costs.
- › Flexibly annotate, track sources, and display inconsistent and missing information.
- › Allow easy publication and sharing of this data both within the IOU PLA team and among other program administrators.

This platform is somewhat limited in its ability to link multiple related products or to “push” out new versions to users, however. In future updates, the project team recommends considering integrating the RSW I, RSW II, and other appliance research in a relational database, to facilitate ongoing tracking and collect all the market research in a single location.