



Final Report

# Residential Solutions Workbook Phase I: Market View

June 8, 2015

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# Residential Solutions Workbook Phase I: Market View Version 2

June 8, 2015

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# 1. Introduction

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This report documents the development of the Residential Solutions Workbook (RSW). The RSW is a planning document that aggregates and displays energy and market data for 132 plug load devices. Data in the RSW were drawn from evaluation and engineering studies, and market characterization reports. The RSW Version 1.0 was released on June 23, 2014, and the RSW Version 2.0 was released in June 2015, and is available at <http://www.calmac.org>. This report has been updated to reflect changes made to Version 2.0, including:

- › Adding 2013 ENERGY STAR® market share for all products and 2011 California ENERGY STAR market share for selected products. (Household View Tab)
- › Adding 2013 Potential Study unit energy savings, technical potential, Title 20 unit savings and Title 20 compliance rate for overlapping Tier 1 products. (Device View Tab)
- › Incorporating both gas and electric savings for all dual fuel products. (Throughout)

## Dashboard Purpose

The RSW is a tool to support residential energy efficiency program planning. The RSW data is “order-of-magnitude accurate,” intended to provide a single quick reference or starting point to present device-level data drawn from multiple sources and allow users to compare devices and prioritize opportunities as well as identify gaps in available data. The RSW is not intended to serve as a business or market planning tool, nor is it intended to directly support forecasting or reporting.

## Project Background

The RSW was initiated in 2013 by the California investor-owned utilities (IOUs) and led by Southern California Edison (SCE). The RSW was conceived as an *MS Excel* workbook that would aggregate data for plug load devices modeled on the Lighting Solutions Workbook (LSW), a similar project for lighting measures that was completed in January 2012.

## Next Steps

Based on IOU program team feedback, the project team has developed a list of potential additions to the RSW I, including new data and display capabilities. To inform planning, the team recommends updating these data every two years, at a minimum.

## 2. RSW Overview

### 2.1. Devices

The RSW contains energy and market data for 132 plug load devices. A subset of 21 “high priority” devices was designated for additional data collection because of their importance to the utility programs. Table 2-1 lists all 132 devices in the RSW, with the 21 high priority devices underlined.

**Table 2-1. List of Plug Load Devices in the RSW (“High Priority” Devices Underlined)**

Air cleaner	Electric blanket	Musical equipment	Soundbar
Answering machine	Electric can opener	Network attached storage drive	Specialty cooking
Aquarium - Lights, pumps	Electric car	<u>Network equipment</u>	Stand-alone electric mixer
Attic fan	Electric fence	<u>Notebook (portable computer)</u>	<u>Stand-alone freezer</u>
<u>Audio/Video receiver</u>	Electric grill	Occupancy sensor	Sump pump
Barbeque - Electric	Electric kettle	<u>Oven/Range - Electric</u>	Telephone
Barbeque - Gas	Electric warmer/serving tray	Oven/Range - Gas	<u>Television</u>
Battery charger	Espresso machine	Patio heater	Thermostat - Smart
Beverage cooler	Evaporative cooler	Pond pump	Timer for devices, lights, etc
Boiler	External hard drive	Pool heat - Gas	Toaster/Toaster Oven
Carbon monoxide detector	Fax	<u>Pool pump</u>	Tooth brush
Ceiling fan	Fireplace	Popcorn maker	Towel warmer
Cell phone charger	Food processing	Portable AC	Trash compactor
Central AC	<u>Furnace - Fan</u>	Portable electric grill	Uninterruptible power supply
Ceramics - Kiln - Electric	Game console	Portable fan	Vacuum cleaner - Built-in
Ceramics - Kiln - Gas	Garage door opener	Portable space heater	Vacuum cleaner - Portable
Ceramics - Pottery wheel	<u>Gas space heating</u>	Power tool	Ventilating fan
Clock	Hair dryer - Blow dryer	Primary electric heat	Video streaming/OTT device
<u>Clothes dryer - Electric</u>	Heat pump	Printer	Waffle maker
<u>Clothes dryer - Gas</u>	Home automation	Projector	Warmer - Baby bottle/Food
Clothes iron	Home shop device	Radio	Waste disposal/Insink-erator
<u>Clothes washer</u>	Home Theater in a Box	<u>Refrigerator/freezer</u>	Water cooler
Coffee maker	<u>Hot tub/Spa - Electric</u>	Renewable energy component	Water pik
<u>Compact audio</u>	Hot Tub/Spa - Gas heat	Ride-on toy car	Water purification system
Copier	<u>Hot water heater - Electric</u>	Room AC	Water softener
Crockpot	<u>Hot water heater - Gas</u>	Rug cleaner	Waterbed heater
Curling iron	Hot water recirculation pump	Sauna	Well pump
Decorative gas fireplace	Humidifier	Scanner	Whole house fan
Dehumidifier	Ice maker	Security system	
<u>Desktop (non-portable computer)</u>	Infant monitor transmitter	<u>Set top box</u>	
Digital photo frame	Irrigation system	Sewing machine & peripherals	
Dishwasher	Knife sharpener	Shaver	
<u>Display</u>	Media player/recorder	Shredder	
Door bell	Medical equipment	Smart power strip	
	<u>Microwave oven</u>	Smoke detector	

## 2.2. Workbook Structure

The RSW contains two dashboard “views,” three data tabs, two source tabs, and a “Read Me” tab:

- › **Dashboard “views”:** Compact visual displays of energy use and market data. The dashboards are the user’s primary entry point to the RSW.
- › **Data tabs:** Data tabs house all data displayed in the RSW. The data tabs may be useful to users seeking to export data from the RSW.
- › **Source tabs:** A complete list of the sources for each data point in the RSW. The source tab can be accessed directly or by using the links in the dashboards, which will take the user directly to the relevant source.
- › **Read Me tab:** A brief introduction to the RSW.

### Dashboards

The two RSW dashboards are the “Household View” and the “Device View.”

#### Household View

The Household View dashboard displays data for all 132 plug load devices and can be filtered by fuel type, end use, and utility territory. The displayed devices can also be sorted by market indicator in descending order.

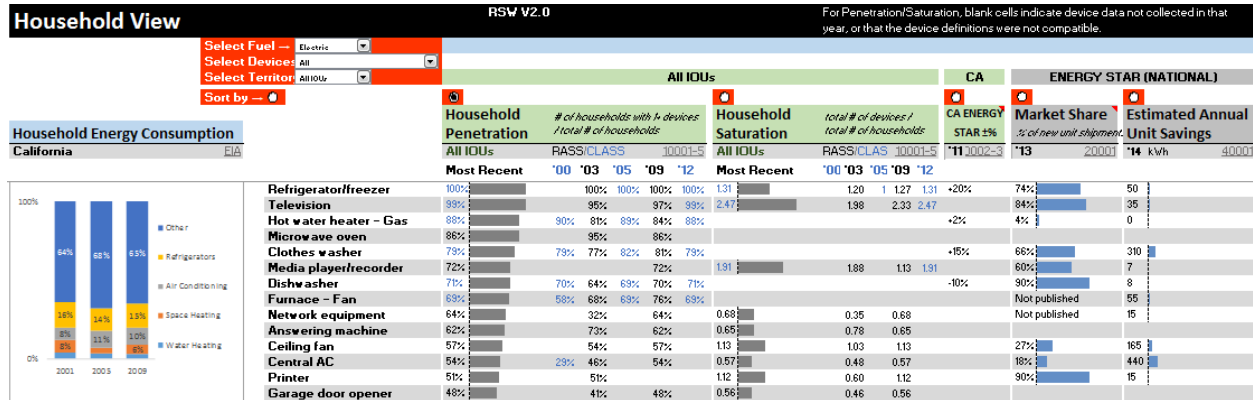
Table 2-2 lists the market indicators in Household View dashboard.

**Table 2-2. RSW Household View: Market Indicators**

INDICATOR	DESCRIPTION	LEVEL OF DETAIL		
		NATIONAL	CALIFORNIA	IOU TERRITORY
Household energy consumption	Percent of California household energy use by end-use category		X	
Household penetration	Percent of households with one or more devices			X
Household saturation	Average number of devices per household			X
ENERGY STAR market share	ENERGY STAR models as a percent of new unit shipments	X	X	
ENERGY STAR estimated unit energy savings	Estimated savings of ENERGY STAR model over baseline model	X		

Figure 2-1 shows a screen shot of the Household View dashboard.

Figure 2-1. RSW Household View: Dashboard Screen Shot



## Device View

The Device View dashboard displays data only for the subset of 21 “high priority” products that were selected at the outset of the project as being of greater importance to utility program managers. The devices can be filtered by fuel type, end use, and utility territory (as in the Household View). Users may also “custom select” the devices they wish to display.

Table 2-3 lists the market indicators in Device View dashboard.

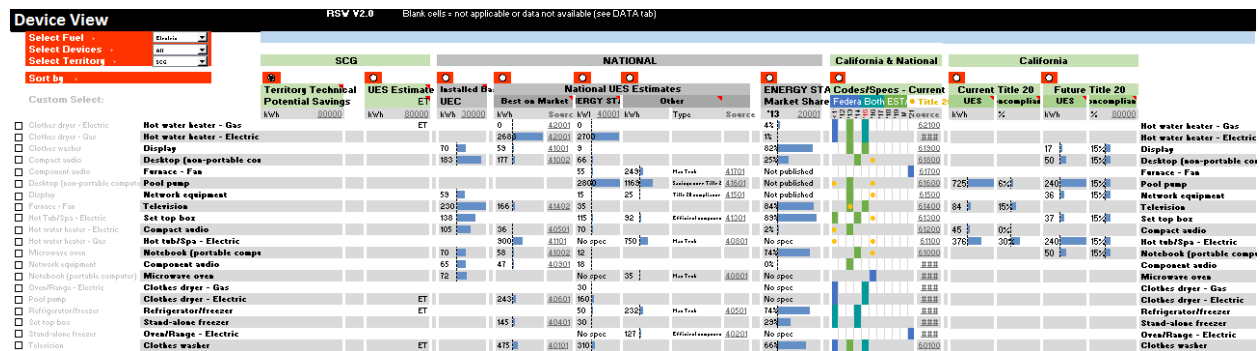
Table 2-3. RSW Device View: Market Indicators

INDICATOR	DESCRIPTION	LEVEL OF DETAIL		
		NATIONAL	CALIFORNIA	IOU TERRITORY
Territory Technical Potential Savings	Estimated territory-wide savings of replacing all devices with efficient models			X
UES estimate	Unit energy savings estimate			X
Installed base unit energy consumption	Estimated annual energy consumption of installed units	X		
Unit energy consumption savings estimates	Estimated savings from Best on Market, ENERGY STAR, or other efficient model types	X		
ENERGY STAR market share	ENERGY STAR models as a percent of new unit shipments	X		










INDICATOR	DESCRIPTION	LEVEL OF DETAIL		
		NATIONAL	CALIFORNIA	IOU TERRITORY
Codes and specifications update timeline	Current and future updates to Federal and California Title 20 standards, and ENERGY STAR specifications	X	X	
Title 20 Current and Future Savings and Compliance	Estimated current and future savings from Title 20 compliance, and estimated compliance rate.			
ENERGY STAR model availability by device price point	ENERGY STAR models as a percent of all models available at retail, by price point	X		

Figure 2-2 and Figure 2-3 show screen shots of the Device View dashboard market indicators described above.

**Figure 2-2. RSW Device View Dashboard Screen Shot: Energy and Code Indicators, Custom Select Control**



**Figure 2-3. RSW Device View Dashboard Screen Shot: ENERGY STAR Model Availability by Device Price Point**

ENERGY STAR Availability by Device Price Point										Source
Average ESTAR Model Penetration			Price Range	Low Price Constraint		ESTAR Model Penetration by Price Point			High Price Constraint	
				Price	% ESTAR	Min		Max	Price	% ESTAR
White Goods	Clothes washer	93%	Under \$500 to \$1500	Under \$500	25%				No constraint	
	Refrigerator/freezer	83%	Under \$400 to \$2500 or more	Under \$600	36%				No constraint	
	Stand-alone freezer	57%	Under \$300 to \$900 or more	Under \$500	32%				No constraint	
	Hot water heater - Electric	5%	Under \$300 to \$700 or more	Under \$700	0%				No constraint	
	Hot water heater - Gas	20%	Under \$400 to \$1000 or more	Under \$600	0%				\$1000 or more	0%
	Pool Pump	36%	Under \$800 to \$800 or more	Under \$800	15%				No constraint	
Electronics	Desktop (non-portable computer)	22%	Under \$250 to \$1000 or more	No constraint					\$1000 or more	0%
	Display	50%	\$50 to \$750 or more	No constraint					No constraint	
	Notebook (portable computer)	44%	Under \$250 to \$1999	No constraint					\$1500 - \$1999	19%
	Television	58%	Under \$200 to \$3000 or more	No constraint					\$2500 or more	24%

The Device View dashboard also includes a “Device Snapshot” that aggregates most of the market indicators in the RSW for a single device, selected by the user with a drop-down menu. Figure 2-4 shows a screen shot of the Device Snapshot.

**Figure 2-4. RSW Device View Dashboard Screen Shot: Device Snapshot**

Device Snapshot

Select device →

Television

Device notes:

Baseline Energy Use

Source

Installed Base UEC

230 kWh

30000

National UEC Savings

Source

Best on Market

166 kWh

41402

Energy Star

35 kWh

40001

Other

Other Type

Notes: Assumed annual run hours of 1,882 (5.16 hours/day \* 365 days); ENERGY STAR average over all sizes

All IOUs RASS/CLASS

'00

'03

'05

'09

'12

Source

HH Penetration

N/A

95%

N/A

97%

99%

RASS/

HH Saturation

N/A

1.98

N/A

2.33

2.47

CLASS

ENERGY STAR Market Share (new unit sales)

84%

20001

Price Point Availability

50000

Price range

# Models

% ESTAR

Overall:

Under \$200 to \$3000 or more

297

58%

Low end:

No constraint

N/A

N/A

High end:

\$2500 or more

41

24%

Notes:

Current Codes and Specifications

Effective Date

Source

US:

N/A

CA:

Title 20 Section 1605.3(v)2: Televisions

1/1/13

60104

ESTAR:

Television Program Requirements Version 6.1

6/1/13

61401

Upcoming Codes and Specifications

Expected Effective Date

Source

US:

N/A

CA:

Not collected

ESTAR:

Television Program Requirements Version 7.0

7/1/15

61402

## Data Tabs

The three RSW data tabs are:

- > **“DATA”**: Characteristics, energy, and market data for all devices in the RSW
- > **“Category Data”**: Raw data and bar charts for California household energy consumption by end-use category
- > **“Price Point Data”**: Raw data for the ENERGY STAR Availability by Device Price Point section of the Device View dashboard



Figure 2-5 shows a screen shot of the DATA tab.

Figure 2-5. RSW “DATA” Tab Screen Shot

Device Information						
Adapted from draft 2013 SCE list of energy-using devices			IOU Research Priority		CLASS	RASS
			Tier 1 = Highest, most data collection. Tier 2 & 3 =		-98 = unclear from source; -99 = N/A (not collected in source)	-98 = unclear from source; -99 = N/A (not collected in source)
Device Name	Device Notes	Device Category	Device Research Priority	Device Fuel	Statewide HH Penetration 2001	Statewide HH Penetration 2003
Air cleaner		HVAC	Tier 3	Electric		5%
Answering machine		Office Equipme	Tier 3	Electric		72%
Aquarium - Lights, pumps		Other	Tier 3	Electric		8%
Attic fan		HVAC	Tier 3	Electric		6%
Audio/Video receiver	Includes component audio sys	Entertainment	Tier 1	Electric		-99
Barbeque - Electric		Cooking	Tier 3	Electric		1%
Barbeque - Gas		Cooking	Tier 3	Gas		6%
Battery charger	Includes other products with r	Other	Tier 3	Electric		-99
Beverage cooler	Wine, beer, other	Refrigeration	Tier 3	Electric		-99
Boiler		HVAC	Tier 2	Gas		1%
Carbon monoxide detector		Security	Tier 3	Electric		-99
Ceiling fan		HVAC	Tier 2	Electric		53%
Cell phone charger		Other	Tier 3	Electric		-99
Central AC		HVAC	Tier 2	Electric		44%
Ceramics - Kiln - Electric		Hobbies	Tier 3	Electric		1%
Ceramics - Kiln - Gas		Hobbies	Tier 3	Gas		0%
Ceramics - Pottery wheel		Hobbies	Tier 3	Electric		-99
Clock		Other	Tier 3	Electric		-99

## Source Tabs

The two RSW source tabs are:

- › **“DATA Source #s”**: Identical to the DATA tab, but with cell contents identifying the source numbers for each data point in the DATA tab.
- › **“Source Info”**: Citations for all sources from which RSW data are drawn. Each citation includes the document author, publication date, title, web address, and date accessed.



Figure 2-6 shows a screen shot of the Source Info tab.

**Figure 2-6. RSW Source Info Tab Screen Shot**

Source ID	Sub-source Organization	Date Published	Title	Web Address	Date Accessed
1	EIA	2001, 2005, 2009	Residential Energy Consumption	<a href="http://www.eia.gov/consumption/residential/data/2009/">http://www.eia.gov/consumption/residential/data/2009/</a>	5/27/2014
<b>RASS/CLASS</b>					
10001	KEMA	2003	2003 California Residential Appli	<a href="http://websafe.kemainc.com/rass2009/Default.aspx">http://websafe.kemainc.com/rass2009/Default.aspx</a>	3/25/2014
10002	KEMA	2009	2009 California Residential Appli	<a href="http://websafe.kemainc.com/rass2009/Default.aspx">http://websafe.kemainc.com/rass2009/Default.aspx</a>	3/25/2014
10003	KEMA	2012	2012 California Lighting and Appl	<a href="https://websafe.kemainc.com/projects62/Default.aspx?tabid=190">https://websafe.kemainc.com/projects62/Default.aspx?tabid=190</a>	3/25/2014
<b>ENERGY STAR Market Share</b>					
20001	ENERGY STAR	2012	ENERGY STAR Unit Shipment and	<a href="http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2012_USD_Sum">http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2012_USD_Sum</a>	
<b>Baseline UEC</b>					
30000	Energy Solutions	2014	DRAFT: Literature Review of Misc	N/A	
<b>UEC Savings</b>					
40101	ACEEE	2013	Saving Energy and Water through	<a href="http://www.aceee.org/files/pdf/white-paper/great-lakes-clothes-washe">http://www.aceee.org/files/pdf/white-paper/great-lakes-clothes-washe</a>	4/10/2014
40102	ENERGY STAR	2013	Savings Calculator for ENERGY ST	<a href="http://www.energystar.gov/buildings/sites/default/uploads/files/applia">http://www.energystar.gov/buildings/sites/default/uploads/files/applia</a>	3/12/2014
40201	Energy Efficiency an	2014	Energy Conservation Standards fr	<a href="http://www.regulations.gov/#!documentDetail;D=EERE-2014-BT-STD-0005">http://www.regulations.gov/#!documentDetail;D=EERE-2014-BT-STD-0005</a>	3/11/2014
40301	LBNL & Collaborativ	2010	Potential Impact of Adopting Ma	<a href="http://aceee.org/files/proceedings/2010/data/papers/2214.pdf">http://aceee.org/files/proceedings/2010/data/papers/2214.pdf</a>	5/27/2014
40302	ENERGY STAR	2009	Life Cycle Cost Estimate for ENER	<a href="http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc">http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc</a>	3/12/2014
40401	TopTenUSA	2014	Top Ten Freezers	<a href="http://www.toptenusa.org/Top-Ten-Freezers">http://www.toptenusa.org/Top-Ten-Freezers</a>	4/11/2014
40501	Lawrence Berkeley	2011	Max Tech and Beyond - Cumulati	<a href="http://www.energy.ca.gov/appliances/2013rulemaking/documents/respc">http://www.energy.ca.gov/appliances/2013rulemaking/documents/respc</a>	4/11/2014
40601	ENERGY STAR	2014	ENERGY STAR Program Requirem	<a href="http://www.energystar.gov/products/specs/sites/products/files/ENERGY">http://www.energystar.gov/products/specs/sites/products/files/ENERGY</a>	4/11/2014
40602	ENERGY STAR	2014	ENERGY STAR Draft 2 Version 1.0	<a href="http://www.energystar.gov/products/specs/sites/products/files/ENERGY">http://www.energystar.gov/products/specs/sites/products/files/ENERGY</a>	5/7/2014
40701	ENERGY STAR	2011	2011 Market & Industry Scoping R	<a href="http://www.energystar.gov/ia/products/downloads/ENERGY_STAR_Scopi">http://www.energystar.gov/ia/products/downloads/ENERGY_STAR_Scopi</a>	5/7/2014
40801	ACEEE	2013	Miscellaneous Energy Loads in Bu	<a href="http://www.aceee.org/sites/default/files/publications/researchreports/">http://www.aceee.org/sites/default/files/publications/researchreports/</a>	4/11/2014
40901	Energy Solutions	2006	Consumer Electronics: Market Tri	<a href="http://www.etcc-ca.com/sites/default/files/OLD/images/stories/pdf/ETC">http://www.etcc-ca.com/sites/default/files/OLD/images/stories/pdf/ETC</a>	3/12/2014
41001	ENERGY STAR	2011	Savings Calculator for ENERGY ST	<a href="http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc">http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc</a>	3/12/2014

## Read Me Tab

The Read Me tab provides information about the RSW to help users navigate the dashboard and documentation tabs, and interpret the data.

## 2.3. Market Indicators

The RSW aggregates data at the device level for eight market indicators. Data collection was focused on secondary research among published sources, but included one primary data collection activity. Detailed information regarding each market indicator appears below, including its definition, methods and sources of data collection, and any notes or assumptions made during the data collection process.

Table 2-4 provides a summary of the market indicators, data collection methods, sources, and period covered.

**Table 2-4: Summary of Market Indicators, Years Covered, Data Collection Method, and Sources.**

MARKET INDICATOR	YEARS COVERED	DATA COLLECTION METHOD	SOURCE(S)
Household energy consumption by end-use	2001, 2005, 2009	Secondary	U.S. Energy Information Administration (EIA)
Household penetration and saturation by device	2000, 2003, 2005, 2009, 2012	Secondary	California Lighting and Appliance Saturation Study (CLASS), Residential Appliance Saturation Study (RASS)
ENERGY STAR market share	2011, 2013	Secondary	D&R International data; ENERGY STAR Unit Shipment Data
ENERGY STAR estimated annual unit savings	2014	Secondary	ENERGY STAR Data Book
Installed base UEC	Various	Secondary	Energy Solutions
Potential UES	Various	Secondary	ACEEE 2010 and 2012 proceedings, LBNL Max Tech and Beyond
ENERGY STAR availability by price point	2014	Primary	Retailer websites
Codes and specifications	Various	Secondary	U.S. Department of Energy (DOE) specifications, ENERGY STAR specifications, California Energy Commission's Title 20 specifications
Technical potential savings	2013	Secondary	Navigant 2013 CA Potential Study
Potential Study UES	2013	Secondary	Navigant 2013 CA Potential Study
Title 20 UES	2013	Secondary	Navigant 2013 CA Potential Study
Title 20 noncompliance rate	2013	Secondary	Navigant 2013 CA Potential Study

The following eight tables provide a definition, data collection notes, and general comments for each market indicator in the RSW.

**Table 2-5. RSW Market Indicator Details: Household Energy Consumption by End-Use**

Definition	Percent of California household energy consumption by end-use category for single-family households.
Data collection notes	Data were calculated from the U.S. EIA's Residential Energy Consumption Survey (RECS). Raw data are provided in quadrillion BTU (quads).
Comments	EIA data at the state level provides household consumption for a limited number of end-use categories: air conditioning, refrigerators, space heating, and water heating.

**Table 2-6. RSW Market Indicator Details: Household Penetration by Device**

Definition	Percent of California households with one or more devices.
Data collection notes	<p>Data were aggregated and calculated from the California Lighting and Appliance Saturation Study (CLASS) and Residential Appliance Saturation Study (RASS) by querying the online databases. Data were compiled for 2003 and 2009 from the RASS dataset and for 2000, 2005, and 2012 from the CLASS dataset. The project manager for both studies at DNV GL (formerly KEMA) answered questions about interpreting the data.</p> <p>When calculating penetration, the denominator was the number of households in the territory served by the applicable fuel. Survey respondents who did not answer the question or answered “Don’t know” were treated as “no” responses. Penetration could not be estimated when the RSW device definitions were incompatible with the RASS/CLASS definitions.</p>
Comments	None

**Table 2-7. RSW Market Indicator Details: Household Saturation by Device**

Definition	Average number of devices per California household.
Data collection notes	<p>Data were aggregated and calculated from the California Lighting and Appliance Saturation Study (CLASS) and Residential Appliance Saturation Study (RASS) by querying the online databases. Data were compiled for 2003 and 2009 from the RASS dataset and for 2000, 2005, and 2012 from the CLASS dataset. The project manager for both studies at DNV GL (formerly KEMA) answered questions about interpreting the data.</p> <p>When calculating saturation, the total number of devices was calculated and divided by the total number of surveyed households in the territory served by the applicable fuel. Saturation could not be estimated when the RSW device definitions were incompatible with the RASS/CLASS definitions, and when the studies did not include the number of devices per household.</p>
Comments	At the device level, saturation is greater than penetration because some households have more than one unit.

**Table 2-8. RSW Market Indicator Details: ENERGY STAR Market Share**

Definition	<p>ENERGY STAR models as a percent of new unit shipments.</p> <p>And: California ENERGY STAR models as a percent of new unit shipments.</p>
Data collection notes	<p>ENERGY STAR market share data were drawn from the ENERGY STAR Unit Shipment and Market Penetration Report for 2013. ENERGY STAR publishes the market share, and notes that it is calculated by dividing ENERGY STAR qualified shipments (as reported by ENERGY STAR partners) by total U.S. shipments (as defined by ENERGY STAR).</p> <p>California-specific 2011 ENERGY STAR market share data were purchased from D&amp;R International. These data were compared with the publicly available 2011 National ENERGY STAR market share data from the 2011 Unit Shipment and Market Penetration report to calculate the difference between California and National market penetration.</p>
Comments	<p>Data were collected for all RSW devices listed in the ENERGY STAR Unit Shipment and Market Penetration Report.</p> <p>For California-specific data, only selected devices were available for purchase. Only those corresponding devices are shown for national 2011 market share.</p>

**Table 2-9. RSW Market Indicator Details: ENERGY STAR Estimated Unit Energy Savings**

Definition	Estimated savings of ENERGY STAR models over baseline models.
Data collection notes	Data were provided directly by ENERGY STAR based on 2014 specifications.
Comments	Data were requested from ENERGY STAR for all devices with an ENERGY STAR specification.

**Table 2-10. RSW Market Indicator Details: Installed Base Unit Energy Consumption**

Definition	Estimated annual energy consumption of installed units.
Data collection notes	Data were provided by Energy Solutions and drawn from their report, Literature Review of Miscellaneous Energy Loads (MELs) in Residential Buildings.
Comments	Device definitions differed between the RSW and the source document for four device types: audio/video receiver, compact audio, network equipment, and set top box. Differences are noted in the RSW DATA tab.

**Table 2-11. RSW Market Indicator Details: Unit Energy Savings Estimates**

Definition	Estimated savings from Best on Market or other efficient model types over baseline models.
Data collection notes	Collected for the 21 “high priority” devices. Secondary data collection focused on two sources, LBNL’s 2010 Max Tech and Beyond report and ACEEE Summer Study conference proceedings from 2010 and 2012. A third source was consulted for some devices and varied by device type. Savings from other efficient model types were generally collected when Best on Market and ENERGY STAR savings estimates were unavailable.
Comments	None

**Table 2-12. RSW Market Indicator Details: Codes and Specifications Update Timeline**

Definition	Current and future updates to Federal and California Title 20 standards, and ENERGY STAR specifications.
Data collection notes	Collected for the 21 “high priority” devices. Data were collected on Federal mandatory specifications from the Department of Energy, national voluntary specifications from ENERGY STAR, and the California Energy Commission’s mandatory Title 20 specifications.
Comments	No data was collected for upcoming Title 20 standards.

**Table 2-13. RSW Market Indicator Details: ENERGY STAR Model Availability by Device Price Point**

Definition	ENERGY STAR models as a percent of all models available at retail, by price point.
Data collection notes	<p>This task was the only primary data collected for the RSW.</p> <p>Data were collected for 10 devices (6 appliances, 4 electronics): clothes washer, refrigerator/freezer, and stand-alone freezer, hot water heater – electric, hot water heater – gas, pool pump, desktop, display, notebook, and television. Data collection was conducted in February 2014.</p> <p>Appliance data were drawn from the Sears website and electronics data were drawn from the Best Buy website, the two top retailers in each device category. Pool pump data were drawn from the Leslie's Pool Supply website. Price points were drawn from the price ranges appearing on retailer websites.</p>
Comments	Data were only collected on “high priority” devices sold through retail channels and in which online information included ENERGY STAR qualification status for each model. Retailers did not list ENERGY STAR status for devices with few qualified ENERGY STAR models, for example small network equipment, set top boxes, and audio/video equipment. As a result, these devices could not be included in the price point data.

**Table 2-14. RSW Market Indicator Details: Technical Potential Savings (NEW)**

Definition	Theoretical annual savings from replacing all devices in territory with efficient devices.
Data collection notes	<p>Data for each IOU and for the IOUs' combined territory was drawn from the 2013 Potential and Goals Model for the 14 devices that aligned with devices in the RSW. In some cases, the technical potential for two measures in the model were summed to get the overall technical potential for that device (for example, tankless and storage gas water heaters.) Where the study defined separate gas and electric measures (for example, clothes washers), the team used the gas measure for gas savings and the electric measure for electric savings, per the study authors' instructions – this may lead to an overestimation of savings, a caveat noted in the workbook.</p> <p>The study authors at Navigant provided input to incorporate this data.</p>
Comments	<p>Technical Potential estimates are estimates of the technically feasible savings based on current or emerging technology, and do not take into account real-world constraints on efficient technology uptake, such as cost-effectiveness, lifecycle, availability, market barriers, and consumer adoption.</p> <p>For some devices, technical potential is based on emerging technologies that are nearing commercial availability or where the technology is projected to improve.</p> <p>Note that the 2013 Energy Efficiency Potential and Goals Study does not include results from the 2010-2012 evaluation cycle.</p>

**Table 2-15. RSW Market Indicator Details: 2013 Potential Study Unit Energy Savings (NEW)**

Definition	Annual unit energy savings of an efficient device over a baseline device
Data collection notes	<p>Data for each IOU was drawn from the 2013 Potential and Goals Model for the 15 devices that aligned with devices in the RSW. Weighted averages were calculated to estimate the average UES across all IOUs.</p> <p>Where the study defined separate gas and electric measures (for example, clothes washers), the team used the gas measure for gas savings and the electric measure for electric savings, per the study authors' instructions – this may lead to an overestimation of savings, a caveat noted in the workbook.</p> <p>For SCE and SCG, inclusion of gas and electric savings matches the conventions in the model.</p> <p>The study authors at Navigant provided input to incorporate this data.</p>
Comments	<p>In the Potential and Goals Model, some devices have both "standard" and emerging technology measures. The emerging technology savings estimates have been included instead of the standard savings estimates, and are noted where applicable.</p> <p>Note that the 2013 Energy Efficiency Potential and Goals Study does not include results from the 2010-2012 evaluation cycle.</p>

**Table 2-16. RSW Market Indicator Details: Title 20 UES (NEW)**

Definition	Annual unit energy savings from adoption of Title 20 standards
Data collection notes	<p>Data was drawn from the 2013 Potential and Goals Model for the 12 devices with current or upcoming Title 20 standards that aligned with devices in the RSW.</p> <p>For devices with existing specifications that were implemented in phases, only the most recent specification is included.</p> <p>The DATA tab also includes CASE (Codes and Standards Enhancement) study report estimates of the noncompliant UEC, compliant UEC, and compliance UES.</p> <p>The study authors at Navigant provided input to incorporate this data.</p>
Comments	The 2013 Potential Study values shown in the summary tab come from a CEC analysis.

**Table 2-17. RSW Market Indicator Details: Title 20 Noncompliance Rate (NEW)**

Definition	Estimated rate of noncompliance with Title 20 standards
Data collection notes	<p>Data was drawn from the 2013 Potential and Goals Model for the 12 devices with current or upcoming Title 20 standards that aligned with devices in the RSW.</p> <p>The study authors at Navigant provided input to correctly incorporate this data.</p>
Comments	These values come from a CEC analysis.

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The list below includes all the sources from which the RSW data have been drawn.

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### 3. Research Approach and Activities

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The project team developed the RSW as a *MS Excel* workbook with a “dashboard” interface. The RSW was developed through close collaboration between Research Into Action and the California IOU team. The process of designing the RSW included:

- › **Identifying the devices and market indicators.** Working from a list of household energy using devices provided by PG&E, the project team refined this list to align with device definitions in key data sources such as the Energy Solutions Miscellaneous Energy Loads report and ENERGY STAR specifications. The IOU team provided feedback on a draft list of market indicators useful for program planning, and the final list was developed based on this feedback and data availability.
- › **Assessing user requirements for the dashboard.** The project team worked with the IOU team to understand the types of questions they would like to answer using the dashboard. The project team also consulted the LSW developers and users to understand how they used the workbook.
- › **Building the Excel workbook.** Based on the market indicators and dashboard user requirements, the project team drafted the workbook and collected data using the sources described above.
- › **Verifying data.** To ensure data accuracy, a second team member verified all the data collected. Where possible, data was provided or verified by the source author: ENERGY STAR provided ENERGY STAR savings data, DNV GL answered questions about the RASS and CLASS data, Energy Solutions verified the installed base UEC estimates, and Navigant provided input on the 2013 Potential Study savings and Title 20 data.
- › **Conducting user interface testing with stakeholders.** The project team conducted user interface testing sessions with 15 members of the statewide IOU teams, observing as they interacted with the dashboard. Testers provided suggestions for how to clarify information presentation and suggestions for additional market indicators and comparisons. Based on these testing sessions, the team refined the dashboard and developed a list of potential next steps.
- › **Presenting the dashboard.** The project team presented the final dashboard to stakeholders in a webinar and provided additional support to dashboard users.

## 4. Next Steps

In addition to regular updates (at least once every two years), there are several possible next steps for the Residential Solutions Workbook. Utility and Research Into Action staff all suggested ways to increase the tool's functionality. Table 4-1 describes each potential next step and Research Into Action's assessment of the level of effort required (low, moderate, high).

**Table 4-1. Residential Solutions Workbook Phase I: Next Steps**

ACTIVITY	LEVEL OF EFFORT
<b>ADD DATA</b>	
<b>Expand data collection to additional devices.</b> In developing the RSW v1.0, the team selected 21 "high priority" devices on which to collect data of greater depth, including a literature review to identify potential unit energy savings, upcoming codes and standards changes, and the retail availability of efficient devices by price point. These metrics could be collected for additional devices. This activity would include data collection and limited revisions to the Excel programming to display the additional data on the Device View dashboard.	Moderate
<b>Add characteristics of the installed base.</b> RASS and CLASS contain some variables on the characteristics of devices in the installed base, for example, efficiency level and age. These characteristics could be added to the RSW. This activity would involve reviewing the available data in RASS and CLASS, selecting the metrics to add to the RSW, and redesigning and reprogramming the dashboard to accommodate the new data.	Moderate
<b>Compare federal and California efficiency standards, identifying where California leads.</b> The specification data in the RSW v1.0 are limited to a timeline of upcoming changes. Additional data regarding the relative stringency of federal v. California standards could be collected (and potentially added) to the next version of the RSW.	High
<b>Add ENERGY STAR penetration data from alternative sources.</b> ENERGY STAR publishes its unit shipment (new unit sales penetration) data annually and is between one and two years behind the most current sales. For example, as of May 2014, the most current unit penetration data available from ENERGY STAR date to 2012. Alternate sources could be sought to update (and compare with) data from ENERGY STAR. For example, Gartner's PC data includes a variable for ENERGY STAR qualification. This activity would require sourcing, purchasing, and analyzing data for each device, as well as updating the RSW.	High
<b>Add market indicator: new unit sales.</b> A useful metric for program managers is the annual volume of new unit sales. This metric could be added to the RSW for all or a selection of devices. The data would need to be sourced and (likely) purchased. The addition of new unit sales would require the RSW to be updated annually at a minimum due to the variability in this metric.	High



ACTIVITY	LEVEL OF EFFORT
<b>Add market indicator: sales trends.</b> Utilities are concerned with both sales volume and potential growth (and decline). The RSW v1.0 does not include a metric for trends in unit sales. This could be added and would require sourcing the data for each device and redesigning and reprogramming the dashboard to accommodate it.	High
<b>Add market indicator: qualitative market characteristics.</b> The RSW displays primarily quantitative metrics. Additional market indicators related to market characteristics (for example, market barriers or supply chain structure) are important to utilities as they move into the next program cycle. These indicators could be added to the RSW, and would require either creation of a new dashboard or the development of an alternate approach to displaying these qualitative data.	High
<b>Add market indicator: efficiency of high-end and low-end “baskets of goods” following the Consumer Price Index model.</b> The CPI tracks changes in the prices of a “basket” of representative goods. The same model could be used to track the efficiency of new devices, with the creation of separate baskets for goods at high and low price points. This activity would produce a market indicator that could be used to measure market transformation over time, and would allow program managers to compare the efficiency of high vs. low-priced devices. The activity would require the development of the device “baskets” and a methodology for data collection and analysis. Periodic updates would also be necessary to deliver on the potential of the metric.	High
<b>ADD DISPLAY OPTIONS</b>	
<b>Allow users to compare data by utility territory.</b> The RSW v1.0 allows users to view data at the utility territory level for only one utility at a time. A dashboard could be created to allow users to view data for multiple territories simultaneously. This new view would facilitate comparisons across utility territories, for example, of device penetration or potential savings. This activity would be focused on the design and programming of a new dashboard. No new data collection is anticipated.	Moderate
<b>Allow users to view all water-consuming devices, regardless of fuel type.</b> The RSW v1.0 requires the user to select a fuel type (gas or electric) and shows only devices for one fuel type at a time – users cannot view all devices simultaneously. A new dashboard could be created to allow users to view all water-consuming devices (for example, gas and electric water heaters, clothes washers, etc.). This activity would be focused on the design and programming of a new dashboard. No new data collection is anticipated.	Moderate
<b>NEW RESEARCH QUESTIONS</b>	
<b>What proportion of households with pools heat them with gas?</b> The RASS and CLASS datasets include a wealth of data on California households. The RSW v1.0 draws on just two of the many variables: device-level penetration and saturation. These data sets can be used to answer additional research questions regarding the California installed base, like the one noted above, and others. This activity could also include incorporating the findings into the next revision of the RSW.	Moderate
<b>How much household energy consumption is accounted for in the identified device categories?</b> The RSW v1.0 includes 132 plug load devices (excluding lighting). Additional research could be conducted to determine the proportion of household energy use accounted for by the devices in the RSW, and to identify any energy-using devices not currently included. This activity could also include incorporating the findings into the next revision of the RSW.	High



ACTIVITY	LEVEL OF EFFORT
<p><b>Are there other sources of penetration and saturation data that can be used to supplement RASS and CLASS?</b></p> <p>RASS and CLASS lack household-level data for some devices in the RSW. Other sources could be sought to make the penetration and saturation data more complete. For example, the Appliance Recycling Program evaluations could provide another source of data on refrigerator penetration/saturation. The complexities of this activity including sourcing the additional data and revising the dashboard design to accommodate penetration and saturation data from multiple sources.</p>	High
<p><b>What is the relationship between household income and the price point and efficiency of a household's devices?</b></p> <p>The 2012 CLASS study includes household income data and device efficiency levels. A third-party marketing database (available for purchase at a reasonable cost) includes data from the 1990s regarding household characteristics and plug load purchases (including the device purchase price). These two data sets could be used to delve further into the relationship between household income, device efficiency, and device price point. A study addressing these questions was presented by Research Into Action in a separate scope of work in Q1 2014 but not funded.</p>	High
<b>DISSEMINATION, UPDATES, AND VERSION CONTROL</b>	
<p><b>Provide small-group virtual trainings to introduce utility staff to the RSW.</b></p> <p>A series of virtual trainings with utility staff could be held to demonstrate the RSW and answer questions. These could be conducted using free web conferencing software and are anticipated to last 30-60 minutes.</p>	Low
<p><b>Develop and plan for scheduled updates to ensure that the RSW remains relevant.</b></p> <p>The market indicators in the RSW will need to be updated on an annual basis, at a minimum. A regular update schedule and procedure could be established such that the RSW remains relevant to users.</p>	Low
<p><b>Put the RSW online.</b></p> <p>The RSW could potentially be accessed online, rather than downloaded and opened as a desktop Excel file. This could be accomplished by employing the capabilities of Office 2013 or by recreating the dashboards using web-based software. These options would have varying costs but share the advantage of improved version control.</p>	High