PACIFIC GAS & ELECTRIC ENERGY STAR RETAIL PRODUCTS PLATFORM (ESRPP) PILOT EVALUATION

Appendices

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APPENDIX A: DETAILED REGRESSION MODELING METHODS

The primary approach taken by EMI Consulting to estimate increases in sales rates for qualified products is based on modeling sales rates in the pre-program period, using the model to predict sales into the program period, and the comparing the predictions to the observed sales rates. This process involved normalizing sales for seasonality, developing three models of sales in the pre-program baseline period, predicting program-period sales using the baseline model, and averaging results from the three models.

NORMALIZE SALES FOR SEASONALITY

Because sales vary significantly throughout the year, models of sales levels must account for seasonality. The approach taken by EMI Consulting was to normalize sales levels and develop models based on the normalized sales models. Because overall sales levels are potentially different in the pre-program period and the program period, we treated the calculated the normalized level separately for the pre-program period and the program period. We did this by summing up all qualified product sales by product group in each month and dividing each monthly sales value by the overall average annual share for that calendar month, and then taking the average across all instances of that calendar month to get a normalization factor. We then divide the sales by the normalization factor to calculate normalized sales. That is, the normalized sales value is the sales value relative to the average sales for that month. For example, for refrigerators in July 2017, the normalized sales value is calculated as:

Normalization $factor_{Refrigerators, July 2017}$

_	Sal	.es _{Refrigerators}	s,July2017
_	1/ (Sales _{Refrigerators,Ju}	ly2016	$Sales_{Refrigerators, July 2017}$
	/2\AverageSales _{Refrigerators}	Pre-program	「AverageSales _{Refrigerators,Program} 」

 $NormalizedSales_{Refrigerators,July201y} = \frac{Sales_{Refrigerators,July2017}}{Normalization \ factor_{Refrigerators,July2017}}$

This uses the variation in sales over the full time series of data to normalize sales values so that months that had relatively high sales in both periods will have high seasonal sales, while months with low sales in both periods will have low seasonal value, and months that varied between the periods will have a moderate seasonal value. Normalized penetration rates are then calculated as the ratio of normalized program-qualified sales to normalized total sales. We normalize qualified and non-



qualified sales separately to allow for different patterns between the qualified and non-qualified products.

FIT BASELINE MODELS

Based on the normalized sales numbers, EMI Consulting developed three statistical models of the baseline sales behavior. The first modeled the normalized monthly sales values, under the assumption that the effect of the program is to increase the sales of qualified products. For each product category, model one takes the form,

$NormalizedSales_{month} = \beta_0 + \beta_1 Timetrend_{month} + \varepsilon_{month}$

Where β_0 is an intercept, β_1 is the average increase over time, *Timetrend*_{month} is the number of months since the beginning of the data, and ε_{month} is an error term. The second modeled the monthly penetration rate, under the assumption that the effect of the program is to increase the market share. The third modeled a transformation of the market share, based on the assumption that the effect of the program would have a smaller absolute impact on the market share when the market share is very small or very large, and a larger impact when it is modest. The second and third model take the same form, except that *NormalizedSales_{month}* is replaced by the normalized penetration rate for the second model and the normal cumulative distribution function of the penetration rate for the third model. For each product group and each model, we used leave-one-out prediction model fit to select between an intercept-only sub-model, where β_1 is fixed to zero, and a sub-model with an intercept and a trend. Leave-one-out prediction model fit is a measure of who well the form of the model is able to predict each observation in the model without using it. So for each observation, the sub-model parameters were estimated with all the other data but leaving the target observation out of the data. That observation was then compared to the predicted value for the sub-model that was estimated without it. Between the full sub-model and the intercept-only submodel, the sub-model that gave better prediction fit was selected within each model grouping.

PREDICT SALES

For each product and each product group we used each of the three models to predict sales levels during the program period. For the first model, this involved taking the predicted normalized sales and de-normalizing the data to get predictions of actual sales, multiplying the predicted normalized sales by the normalization factor. For the second model, predicted qualified sales are equal to the predicted qualified market share (to get predicted normalized sales) multiplied by the normalization factor. For the third model, the predicted market share value calculated as the inverse cumulative distribution function of the predicted output. This is then used to calculate sales as in the second model.



The three models were averaged based on their prediction model fit during the preprogram period to develop a predicted sales value for each program group. EMI Consulting used a model averaging approach to combine the results from three different prediction models in order to adjust for uncertainty in what the true model is. The model averaging relied on the same leave-one-out prediction error process as described above. The relative weight for each model was determine by numerical optimizations to minimize the sum of the squared leave-one-out prediction errors across the three tier groupings (basic, advanced, all qualified). Estimated increases in qualified product sales were calculated as the difference between the observed sales and the predicted sales. If observed sales were larger than predicted sales, then that constituted an increase in the sales level during the program period. The results of these individual models are shown below in Figure A-1.



Figure A-1. Results for All Statistical Models

CALCULATE CONFIDENCE BOUNDS

To determine if the predicted increases are different from zero with at least 90% confidence, EMI Consulting calculated standard errors for the sum based on the monthly prediction standard errors and model averaging weights. For each model the standard error of the predicted increase was calculated as the square root of the sum of the prediction standard errors. The prediction standard errors incorporate both the uncertainty in the modeled average as well as the variation in each observation around that average, and thus are higher than the standard errors for the model fit alone.



As the overall estimate for the sales increase was a weighted average of the estimates from the three models, we calculated the standard error for the overall estimate as a linear combination where each item had a coefficient equal to its weight:

$$AverageIncreaseSE = \sqrt{\frac{\frac{Model1SE^{2}}{Model1SSPE} + \frac{Model2SE^{2}}{Model2SSPE} + \frac{Model3SE^{2}}{Model3SSPE}}{\frac{1}{Model1SSPE} + \frac{1}{Model2SSPE} + \frac{1}{Model3SSPE}}}$$

where *Model1SE* is the standard error for the predicted increase from model one, *Model1SSPE* is the sum of the squared prediction errors for model one, and other terms are the equivalent values for models two and three.



APPENDIX B: REGIONAL COMPARISON ANALYSIS

A fundamental challenge to understanding ESRPP program impacts is establishing a reliable baseline. This challenge exists for two reasons:

- ESRPP is national in scope, and retailer buying decisions and strategies frequently apply to entire regions (rather than individual stores). This means it is exceedingly difficult to identify a comparison group/area that is sufficiently similar to the treatment group (i.e., PG&E service territory) along key dimensions (i.e., has similar demographic and regulatory characteristics) but is *not* subject to any of the regional influence from ESRPP.
- Outside of full category sales data collected through the ESRPP program from participating retailers, market data required to understand program impacts is either scarce or nonexistent. In cases where such data do exist, for most product categories they do not contain the level of detail required to perform a comprehensive quantitative comparison.¹

For this evaluation, we relied on a quasi-experimental "within participants" approach (i.e., the pre/post model averaging baseline) to mitigate any difficulties associated with finding a suitable comparison group. To supplement this approach, we performed two additional analyses: (1) a comparison of program-qualified share among participating retailers in PG&E service territory to program-qualified share for participating retailers in Southern California Edison (SCE) service territory, and (2) a comparison of volumetric shipment data for California and Massachusetts. These analyses are discussed in more detail below.

1.1 PG&E AND SCE PARTICIPATING RETAILER PROGRAM-QUALIFIED SHARE COMPARISON

We first compared program-qualified share for participating retailers in PG&E service territory to program-qualified share for participating retailers in Southern California Edison (SCE) service territory. These data from SCE's service territory were collected from participating retailers as one requirement for program participation.

The results of this comparison are largely inconclusive, given that (1) SCE data were only available for a limited window of time, (2) it was not possible to compute retailer-specific values because of ESRPP contractual data masking requirements,

¹ For example, the AHAM data discussed in this appendix contain total unit shipment values by state, but do not contain any model-level information that would allow us to compute a program-qualified share.



and (3) it is impossible to precisely quantify any impacts from ESRPP that SCE service territory may have experienced due to the regional nature of retailer decision-making. The graphical results of this comparison are shown below in Figure B-1.



Figure B-1. Participating Retailer Program-Qualified Share Comparison by Product Category: PG&E and SCE

1.2 CALIFORNIA AND MASSACHUSETTS UNIT SHIPMENT DATA COMPARISON

For the period 2015-2017, the Association of Appliance and Home Manufacturers (AHAM) collected unit shipment data for several product categories included in ESRPP: air conditioners, dryers, freezers, refrigerators, and washers. These data provide total unit shipments to a given geographic area by month and year. The evaluation team examined these data for the period 2015-2017 for the states of California and Massachusetts to understand if trends in the overall volume of unit shipments differed *systematically* between the two states.

As shown in Figure B-2, the overall volume of shipments was much higher for California than for Massachusetts in every product category (as expected).





Figure B-2. Comparison of AHAM Unit Shipment Volumes: California and Massachusetts

To better understand what the relative trends were for the two state, the evaluation team normalized values for each state, using the 2015 value (for each product category) as a point of comparison. These results are shown below in Figure B-3. This analysis shows suggests that shipments for these products to California are not increasing uniformly over the ESRPP program period.





Figure B-3. Normalized Comparison of AHAM Unit Shipment Volumes: California and Massachusetts

This analysis also highlights limitations of unit shipment data: (1) It does not afford the ability to compute program-qualified share, and (2) because it is *shipment* data (and not sales data), it lacks the geographic precision of sales data—that is, we cannot know for certain that a unit *shipped* to California was ultimately sold to an end-use customer in California.



APPENDIX C: CUSTOMER BARRIERS ANALYSIS

In order to determine the effectiveness of its ESRPP program, PG&E identified the need to perform a market barriers analysis as part of its ESRPP Program Evaluation contract with EMI Consulting.

The overarching purpose of this analysis was to understand to what extent retailers may be implementing strategies that address any of five customer-facing market barriers which were previously identified as important in the consumer appliances and electronics market.² These market barriers include: Competing Priorities, Information and Search Costs, Product Availability, Inseparability of Product Features, and Performance Uncertainty.² This research was initially intended to rely solely on retailer implementation plans ("Plans") to document these strategies. However, an earlier review of these plans showed that in many places, the Plans lacked sufficient specificity to map retailer activities to market barriers. As such, this analysis was expanded to also include (1) program activities performed by PG&E and/or its field services subcontractor, and (2) the results of in-depth interviews with national-level retail staff (conducted by Cadmus, the multi-region RPP evaluator).

To complete this analysis, EMI Consulting reviewed the following resources provided by PG&E and/or its ESRPP partners to gather specific evidence showing that the five key market barriers mentioned above are in fact being addressed by retailer activities or program activities:

- Retail Products Platform Market Barriers Research Final Report (Research Into Action, February 2017)
- The 2017/2018 Retailer Implementation Plans
- ESRPP National Interviews, February (June 2018)
- PG&E ESRPP Overview by Retailer and Product Category (May 2018)
- PG&E ESRPP Shelf Survey Data (May-June 2018, provided by ICF International

In the table below, we provide a summary of findings showing the extent to which the PG&E ESRPP program may be addressing each of these barriers identified by the Research Into Action report.



² These barriers were identified in the report "Retail Products Platform Market Barriers Research Final Report." (Research Into Action, February 2017)

Table C-1. Customer Market Barrier Analysis

Market Barrier	Addressed in Logic Model?	Addressed in Retailer Plans?	Evidence from In-Store Visits ³	Evidence from National Retailer Interviews
Competing Priorities <i>Customers are unable to</i> <i>obtain the features they</i> <i>value more highly than</i> <i>energy efficiency in an</i> <i>energy efficient model.</i> <i>(applies to all product</i> <i>categories)</i>	Yes; Short-, Mid- & Long- term Customers are able to obtain features in EE models when price is no longer a barrier. Additional work by RPP defining product tiers contribute by incorporating connectivity.	Yes, though in most cases not product-specific Plans include qualified products in holiday promotions and offer reward points for qualified products equal to the RPP incentive.	Yes Qualified models discounted for holiday promotions. Qualified models for multiple product categories showcased.	Yes National Retailer interviewees stated: Marketing of energy efficient products has increased since last year. ESRPP's main influence on marketing strategies is the price they advertise. Price is the most important consideration for customers. Some manufacturers indicated that they are aware of ESRPP and have made changes to their product lines as a result.

³ The promotional period in the retailers' Plans covers April 2017 – March 2018.



Table C-1 (continued). Customer Market Barrier Analysis

Market Barrier	Addressed in Logic Model?	Addressed in Retailer Plans?	Evidence from In-Store Visits ⁴	Evidence from National Retailer Interviews
Inseparability of Product Features Unable to obtain an energy efficient model without also getting other premium features, causing the cost of the efficient model to exceed the perceived benefit. (applies to refrigerators)	Yes; Long-term RPP incentives are designed to motivate retailers to assort and, in turn, motivate manufacturers to design efficient products across a wider range of feature sets. RPP to address inseparability of product features through the same mechanism that it uses to address competing priorities	Partially Plans include activities which indicate retailer interactions with manufacturers. (Ex: trade shows, conferences, merchant team collaborations)	Some Evidence: Observed increases in program-qualified models floored in certain product categories <i>may</i> include non- premium, energy efficient options. Retailers are expected to communicate with manufacturers regarding consumer preferences.	Some Evidence: National Retailer Interviews found: There is significant interaction between retailers and manufacturers in the new product design process. Some manufacturers indicated that they are aware of ESRPP and have made changes to their product lines as a result.
Information and Search Costs Perceives the effort involved in learning about and identifying energy efficient products increases the cost of the efficient model to the point it exceeds the perceived benefit. (applies to clothes dryers, clothes washers, room ACs, soundbars)	Yes; Short-term Promotions and marketing, as well as training of store employees, will help drive customers toward more EE options.	Yes Plans include employee training initiatives, adding Energy Star resources to the retailer website, advertisements, and product placement in- stores.	Yes Promotional signage for qualified models created by store associates. Retailer staff trained on RPP program, customer benefits program, and ROI.	Yes National retailer interviewees stated Internal stakeholders value information provided through ESRPP as it helps the retailers drive category sales.

⁴ The promotional period in the retailers' Plans covers April 2017 – March 2018.



Table C-1 (continued). Customer Market Barrier Analysis

Market Barrier	Addressed in Logic Model?	Addressed in Retailer Plans?	Evidence from In-Store Visits⁵	Evidence from National Retailer Interviews
Product Unavailability	Yes; Mid-term	Partially	Yes	Yes
<i>Unable to purchase an efficient model because it is</i>	Incentives are designed to lead	Plans include activities which	Observed increases in	National retailer interviews found:
impractical or impossible to find efficient models available for purchase.	to increased assortment share of EE models.	indicate retailer interactions with manufacturers.	proportion of program-qualified models stocked in	Merchants have stocked more energy efficient
(applies to heat pump clothes dryers, standalone freezers)	primary mechanisms underlying RPP.	conferences, merchant team collaborations).	categories. ⁶	products, with incentives factoring heavily on their decisions.
				Retailers' sustainability staff share important info with merchants, such as ESRPP incentive details, program requirements, and profitability.

⁶ The shelf assortment data analysis determines "model assortment share," which is the proportion of unique program-qualified models divided by the total number of models for a given product category.



⁵ The promotional period in the retailers' Plans covers April 2017 – March 2018.

Table C-1 (continued). Customer Market Barrier Analysis

Market Barrier	Addressed in Logic Model?	Addressed in Retailer Plans?	Evidence from In-Store Visits ⁷	Evidence from National Retailer Interviews
Performance Uncertainty Customers are unsure whether an efficient model will deliver the promised energy savings while functioning as well as an inefficient option. (applies to heat pump clothes dryers only)	Yes; Mid-term and Long-term ⁸ The ENERGY STAR label is likely to instill confidence in purchasing. ESRPP efforts are also designed to lead to the development of test procedures as part of the ENERGY STAR certification process.	Partially Plans include mentions of signage for qualified models and training, but do not include specifics (in most cases) regarding which models, and do not specifically mention addressing performance uncertainty.	Some Evidence Promotional signage for qualified models created by store associates. (However, no specifics on performance uncertainty of heat pump clothes dryers, which is the only product subcategory for which this barrier applies).	Some Evidence National retailer interviewees stated that ESRPP helps the sales associate to better sell products to customers and adds another level of credibility. (However, no specifics on performance uncertainty of heat pump clothes dryers).

⁸ The Research Into Action report that identified these market barriers indicated that this market barrier is not addressed by ESRPP program theory. However, we believe there is justifiable reason to believe that the current program theory does in fact address this issue, albeit not in the short term.



⁷ The promotional period in the retailers' Plans covers April 2017 – March 2018.

APPENDIX D: PROGRAM PERFORMANCE INDICATORS (PPIs) AND MARKET TRANSFORMATION INDICATORS (MTIs)

Tracking of Program Performance Indicators (PPIs) and Market Transformation Indicators (MTIs) is based on the PG&E ESRPP logic model. In the tables below, we first present PPIs, and then present MTIs. Lastly, a special set of MTIs—Customer Barrier Indicators—are described, though these indicators have not yet been operationalized.



Table D1. Program Performance Indicators: Part 1

LOGIC MODEL COMPONENT	ID	Metric	Data Collection Activity/ Source	Category	Mar-16	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1	
O1.1. Incentives for qualified units sold	01.1	Dollar amount of incentives paid to each retailer by	Sales data portal	All	\$53,880	\$431,010	\$497,050	\$481,480	\$430,000	\$963,510	\$903,220	\$903,640	\$706,610	
		product category		Air Cleaners	\$ 7,820	\$ 36,130	\$ 33,860	\$ 34,120	\$ 41,870	\$ 16,840	\$ 23,170	\$ 33,560	\$ 9,290	
					Air Conditioners	\$ 360	\$ 94,380	\$ 73,360	\$ 3,460	\$ 2,720	\$228,040	\$ 83,840	\$ 1,000	\$ 2,140
					Clothes Dryers	\$43,300	\$278,200	\$361,350	\$395,550	\$359,900	\$349,650	\$374,990	\$434,580	\$350,580
				Freezers	\$ 2,170	\$ 13,690	\$ 11,980	\$ 16,790	\$ 11,580	\$ 21,660	\$ 33,360	\$ 31,040	\$ 16,820	
				Refrigerators	N/A	N/A	N/A	N/A	N/A	\$ 87,740	\$117,020	\$122,480	\$ 81,620	
				Sound Bars	\$ 230	\$ 8,610	\$ 16,500	\$ 31,560	\$ 13,930	\$ 15,700	\$ 35,400	\$ 54,820	\$ 36,480	
				Washers	N/A	N/A	N/A	N/A	N/A	\$243,880	\$235,440	\$226,160	\$209,680	

LOGIC MODEL COMPONENT	ID	Metric	Data Collection Activity/ Source	Category	Mar- 16	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1
O1.2. Sales data platform with monthly retailer data	01.2	Ability of data portal (Low, Medium or High) to enable program operations / program data analysis	Sales data portal	All	High / Med								
O2.1 POP materials in PR stores	02.1	Percentage of months to date where POP materials have been placed in stores	In-store field data	All	N/A	100%	73%	83%	88%	91%	92%	93%	94%
O2.2 Promotional activity data and shelf assortment data gathered	02.2	Percentage of months to date where promotional/shelf survey data have been gathered	In-store field data	All	100%	100%	100%	100%	100%	100%	100%	100%	100%
O2.3 Store associates trained	02.3	Cumulative number of store associates trained	In-store field data	All	-	415	1,020	1,380	1,973	2,739	3,456	4,210	4,935

Table D2. Program Performance Indicators: Part 2

Table D3. Program Performance Indicators: Part 3

LOGIC MODEL			Data Collection	Data Collection		PY 1			P	Y 2					
COMPONENT	D ID	Metric	Activity	Category All All All	2016 Q2 2016 Q3 2016 Q4 2017 Q1		2017 Q2	2017 Q3	2017 Q4	2018 Q1					
O3.1 Coverage of PAs	03.1	Percentage of US population served by ESRPP	Program data review	All		18% 18%									
O3.2 Optimal set of PRs	03.2	Initially, count of major retailers or major retail buying groups. In the longer term, may consider calculating total market share of participating retailers.	Program data review	All		4 major retailers				4 major retailers 5 major retailers				rs	6 major retailers
O3.3 Product categories selected and tiers defined	03.3	Binary: Are product categories selected and tiers defined on an annual basis?	Program data review	All	Yes; however, tier definition is area for improvement				Yes; howev	er, tier definiti	on is area for in	nprovement			

LOGIC MODEL	10	Metric	Data Collection Activity Category Program data review All 2016 Q2 2016 Q3 2016 Q4 2017 Q1 2017 Q2 2017 Q3 2 m Program data review All Image: Collection and the review All Image: Collection and the review Image: Collection and the review and the review All Image: Collection and the review and the revi	Data Collection	Cotocomi		P	Y 1			Р	2														
COMPONENT	טו	Metric		2017 Q4	2018 Q1																					
O4. Input on specifications and standards, product selections and tier definitions using retailer sales data and other sources	O4a	Cumulative number of product categories for which ESRPP has contributed input on specification and standard development	Program data review	All		0 0						2														
	O4b	Percentage of active product categories for which PG&E has participated in product selection and tier definition activities	Program data review	All	100%				10	0%																

Table D4. Program Performance Indicators: Part 4

Note: For general documentation of PG&E ESRPP outreach and advocacy efforts, please see Appendix E.

Table D5. Market Transformation Indicators: Short-Term, Part 1

LOGIC MODEL		Matric	Data Collection	Catagory	у РҮ 1						PY 2	
COMPONENT		Metho	Activity	Category	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1
S1. Increased penetration of qualified models as a result of reduced barriers and increased PR sales of qualified models	51	Program-qualified share for participating retailers by product category (and if possible, compare to national market share for all retailers)	Sales data portal	All		See mai	n report.		S	ee main repo	ort.	See main report.
S2. PRs factor ESRPP incentives and increased demand for PQ models into assortment and marketing/promotions decisions	S2	Percentage of retailers for which we have qualitative evidence on product level considerations, weighted by total sales volume*	Interviews with retailers	All	0%			N/A - No	Interviews co 2017	ompleted in	100% (4 of 4 Retailers Interviewed) of Retailers; Medium- level of influence	

Table D6. Market Transformation Indicators: Short-Term, Part 2

LOGIC MODEL	10	Matria	Data Collection	Data Collection	Data Collection	Data Collection Activity	Category	PY 1						PY 2	
COMPONENT		Metric	Activity	Category	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1			
S3. Specifications/codes/st andards organizations are able to make more timely and informed decisions based on input and data from PG&E/ESRPP.	53	Qualitative assessment using self-report feedback from EPA staff	Interviews with external collaborators	-	N/A No e	xternal colla yı	borator inter ear	views this	Yes External col ESRPP's dat need to land stringent sp efforts." EPA is about prompted b incentivizing levels and h specificatio External col risk of not h accounted f pushback fr	laborator inte a provides mo d. "If EPA is su lecs, it will be t to put out a ly ESRPP's ma g products at lelped EPA adu n levels. llaborator: "Sg having a balanu for. ESRPP hel tom manufact	erviewees indica ore visibility into accessful in gett because of NEE discussion guid rket data. ESRP 30%/50% above vocate for more pecification sett ced pool if utilit ps EPA defend a urers and other	ite that PG&E o where specs ing new/more A and PG&E e that was P has been e current ES e aggressive ing runs the ies are not against s."			

Table D7. Market Transformation Indicators: Mid-Term Indicators, Part 1

LOGIC MODEL					PY 1		PY 1 PY 2		PY 2			
COMPONENT		Metric	Data Collection Activity	Category	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1
M1.1. PRs increase offering and marketing of qualified models	M1.1	Proportion of models on sales floor, within each product category, that are program qualified	In-store field data	All Retailers	See main report.		ll See main report. See main report.		rt.	See main report.		
M1.2. Increase in PQS leads to increases in minimum requirements for RPP product tiers.	M1.2	Cumulative # of active product categories for which minimum tier requirements are increased	Program data review	All Retailers	0		3 Air cleaner basic tier and advar tier both changed by ESRPP (2) Addition of advanced tier for r ACs.		l advanced RPP (2). er for room	4 ES spec change for washers		
M2. PRs purchase additional types of qualified models and more of each type of qualified model from manufacturers	M2	Percentage of manufacturers for which we have qualitative evidence on increased requests for qualified models from manufacturers	Interviews with manufacturers		Not yet tracked. Manufacturer interviews must occur first.		Not yet trac	ked. Manufa	cturer intervie first.	ews must occur		
M3. ESRPP has scale to influence PRs	M3	Self-report feedback from retailers on influence of ESRPP	Interviews with retailers	All Retailers		No; Limited	program sca	le	N/A - No I	nterviews co 2017	mpleted in	Some, but larger scale is desired/nee ded for larger impact

Table D8. Market Transformation Indicators: Mid-Term Indicators, Part 2ª

LOGIC MODEL COMPONENT	ID	Metric	Data Collection Activity	Category	Mar- 16	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1						
M4. ENERGY STAR M4 specification criteria for product categories become more stringent	M4	Percent progress towards ES spec revision metric.	Program data review	All		0%			0%			See individual product categories below							
				Air Cleaners		C	9%			0%			50%						
			Air Conditioners	0%			0%			1%									
										Clothes Dryers		C	9%			C	%		1%
							C	9%			C	%		1%					
				Refrigerators		0%			0%			1%							
				Sound Bars		C	9%			C	%		50%						
				Washers		C	9%			C	%		1%						

^a See Appendix G for more detailed information on specification advancement for air cleaners and soundbars.

Table D8. Customer Barrier Indicators

CUSTOMER BARRIERS	ID	Metric	Data Collection Activity	Availability
Customer Awareness	CB1	Customer awareness of ENERGY STAR or plug load energy efficiency	Surveys with customers. May leverage reports from ENERGY STAR.	Tracking beginning in Q1 2019
Competing Priorities	CB2	Availability of key features in EE models (addresses barrier of Competing Priorities)	Retailer sales data / web-scraping	Tracking beginning in Q1 2019
Inseparability of Features	CB3	Availability of key features in EE models (addresses barrier of Inseparability of Features)	Retailer sales data / web-scraping	Tracking beginning in Q1 2019

APPENDIX E: DETAILED INFORMATION ON PG&E ESRPP OUTREACH AND ADVOCACY EFFORTS

Quarter	Date	Stakeholders	Event/Recognition	Description	Source
2012 Q1		PG&E, Retailers, U.S. EPA	BCE meetings	PG&E met with BCE retailers including Best Buy and Sears and U.S. EPA/ENERGY STAR to discuss the future of the BCE program. PG&E outlined plug-load concept with national platform (Whole Store/RPP), which elicited positive response from retailers and EPA.	Meeting agenda
2012 Q2	4-11-12	U.S. EPA, Retailers, Manufacturers, EEPS	ENERGY STAR Partner of the Year - Award	PG&E received ENERGY STAR Partner of the Year—Sustained Excellence recognition for its campaigns to promote ENERGY STAR certified products, collaborations to help build stakeholder support for ENERGY STAR programs and product specifications, and programs designed to bring ENERGY STAR certified products directly into customer homes and businesses. Key 2012 accomplishments included continuing to offer innovative streamlined ENERGY STAR-focused retail channel programs that cross utility service territory and state lines, simplifying program administration, reducing participation costs for retail and manufacturer partners, and driving a consistent message to customers about the benefits of energy efficiency.	https://www.cee1.org/conte nt/sustained-excellence- award-winners
2012 Q2	4-11-12	U.S. EPA, PG&E	ENERGY STAR Partner of the Year Meeting	PG&E presented to U.S. EPA/ENERGY STAR (Peter Banwell, Hewan Tomlinson) the Future of BCE (Whole Store/RPP) concept. U.S. EPA committed to help support RPP concept development. Discussed strategies for new retail-based programs including an agenda item in 2012 ENERGY STAR Partners meeting.	Future of BCE presentation
2012 Q2	8-2-12	U.S. EPA, PG&E	Meeting	Strategic discussion with U.S. EPA regarding development and implementation of RPP concept and ENERGY STAR's role.	Meeting agenda
2012 Q3	8-17-12	CPUC ED, CA IOUs	Statewide PLA Meeting	IOUs discussed future plans to address PLA energy savings opportunities. IOUs presented 2013-2014 pilot plans. PG&E presented RPP pilot plans and progress in Phase 1 pilot with Kmart. Discussed needs related to market transformation, baselines, and EM&V.	Meeting agenda, presentations
2012 Q4		PG&E, IOUs, EEPS	Meetings	Meetings with SCE and west coast EEPS (West Coast Regional Utility Network) to recruit participation in BCE program. Presented Future of BCE and strategy for progressing from BCE to RPP.	Meeting agenda
2012 Q4	10-24-12	U.S. EPA, Retailers, Manufacturers, EEPS	ENERGY STAR Products Partner Meeting	BCE concept was basis for panel of retailers presenting the topic "Streamlining ENERGY STAR Partner Collaborations on Retail-Based Energy Efficiency Programs." ENERGY STAR Retail Action Council formed during this meeting. Reviewed RPP concept in meetings with Best Buy, Home Depot and Sears.	Presentation

Quarter	Date	Stakeholders	Event/Recognition	Description	Source
2013 Q1	1-9-13	Appliance and Consumer electronics manufacturers. NRDC	CES 2013	initial thoughts regarding future direction of utility PLA programs were discussed with manufacturers, suppliers and retailers, including an outline of RPP concept. Reviewed RPP concept with Noah Horowitz of NRDC.	
2013 Q3	3-27-13	CPUC ED, CA IOUs	PLA Workshop	PLA Program Development Workshop was the first of a series to determine the barriers and possible solutions to developing effective PLA programs. Participants discussed possible program pilots and identified success factors and risks. PG&E presented Whole Store concept (RPP), SCE presented STB energy efficiency, and SDG&E presented Home Energy Management Solution.	PLA-ED Two-day Workshop Agenda, PG&E RPP Pilot presentation
2013 Q4 - 2014 Q4		PG&E, Kmart	RPP Pilot Phase I	PG&E's Retail Plug-load Portfolio (RPP) Phase I Pilot ran from late 2013 through 2014. The RPP was a small-scale (<\$50K in incentives) market transformation initiative that offered incentives to a participating retailer (Kmart) for the sale of specific qualified and efficient consumer electronics and appliances. Although results were mixed due to the limited duration of the pilot, the pilot allowed PG&E to establish a framework with which a larger programmatic effort could proceed.	http://www.cpuc.ca.gov/uplo adedFiles/CPUCWebsite/Cont ent/About_Us/Organization/ Divisions/Office_of_Governm ental_Affairs/Legislation/201 8/13- 15%20Energy%20Efficiency% 20Report_Final.pdf
2014 Q1	1-7-14	U.S EPA, NEEA, PG&E		Meeting to discuss upcoming Product Specification Revisions. For the RPP program, it is important to participate in specification revisions for products other than TVs. RPP design streamlines data processes, reduce per unit transaction costs and accesses total category sales data. Collaboration with EPA and other stakeholders improves estimates of unit energy consumption (UEC) for non-qualified units. Some product categories have very little energy data on non-qualifying units, which makes it difficult to verify actual energy savings and therefore justify EE programs. Proposal for PG&E to work with EPA and other stakeholders to conduct additional research.	Meeting agenda
2014 Q1	2-5-14	CPUC ED, CA IOUs, Sears, Lowe's, Best Buy, Home Depot	Retail Industry Workshop	Presentation and discussion of retail industry to enhance energy efficiency program collaborations among regulators, utilities, retailers and manufacturers to benefit customers and advance energy policy objectives.	Workshop presentation, Notes
2014 Q2	4-15-14	EEPS, retail buyers, retail suppliers	Sears Green Leadership Summit	Introduce RPP concept, including review of Kmart pilot, with Sears' utility partners, Sears suppliers, and Sears staff.	Presentation
2014 Q2	June 2014	CPUC, CA IOUs, EE advocates	CPUC En Banc	PG&E made brief presentation on innovative plug load program concept at statewide CPUC meeting to discuss future strategies for EE programs.	Presentation slide

Quarter	Date	Stakeholders	Event/Recognition	Description	Source
2014 Q3	8-17-14	PG&E, EEPS,EE professionals, Evaluators, Regulators	2014 ACEEE Summer Study on Energy Efficiency in Buildings	Informal session entitled "Next-Generation, Retail-Focused Residential Energy Efficiency Programs – What to do about EM&V?" Interactive session with 20 participants to introduce RPP concept and identify issues and solutions related to EM&V.	Session agenda and notes
2014 Q3	9-9-14	U.S. EPA, PG&E, SCE, NEEA, NEEP, EVT, DCSEU, NRDC	EPA Workshop: Designing Next Generation Retail Based Efficiency Programs	U.S. EPA led discussion to frame the opportunity for new energy efficiency program and to brainstorm what is needed to make the next generation of retail based programs (RPP) work.	Workshop agenda, Flipcharts, Notes
2014 Q3	Late Septemb er 2014	ENERGY STAR Retail Action Council	RAC Meeting	Meeting with Best Buy, Sears, Home Depot and Lowe's to review RPP concept and discuss recommendations.	
2014 Q4	10-28-14	U.S. EPA, ENERGY STAR Retail Action Council, Manufacturers, EEPS	ENERGY STAR Products Partner Meeting	EE 2.0 – Next Generation Retail Programs - presentation by ENERGY STAR RAC at plenary session outlining retailers' perspectives on utility energy efficiency programs and their endorsement of the RPP concept.	Meeting agenda, ENERGY STAR RAC presentation
2015 Q1	1-22-15	U.S. EPA, EEPS	U.S. EPA Webinar	On-line presentation to introduce potential participants to RPP and update them on progress in developing the RPP pilot. Target date for pilot initiation was 2Q2015.	Webinar presentation - Creating a More Energy Efficient Future for Residential Customers: The ENERGY STAR [®] Retail Products Platform
2015 Q1	2-15-15	Regulators	NARUC 2015 Winter Committee Meetings	Panel presentation to regulatory commissioners and staff discussing RPP concept and regulatory requirements. PG&E provided utility perspective.	Session presentation.
2015 Q2	4-20-15	U.S. EPA, ENERGY STAR Retail Action Council, PG&E, NEEA	ENERGY STAR Partner of the Year Meeting	Meetings during annual ENERGY STAR meeting to recruit potential participants.	
2015 Q3	Septemb er 2015	ACEEE	Innovative EE Programs	PG&E's RPP program recognized as innovative residential EE program in ACEEE report entitled, "New Horizons for Energy Efficiency: Major Opportunities to Reach Higher Electricity Savings by 2030."	ACEEE Report #U1507, page 34
2015 Q3	10-13-15	U.S. EPA, ENERGY STAR Retail Action Council,	ENERGY STAR Products Partner Meeting	RPP featured at 2015 ENERGY STAR Products partner meeting including U.S. EPA presentation during plenary session, RPP panel session with ENERGY STAR RAC and PG&E presentations.	Meeting agenda, ENERGY STAR RAC presentation, EEPS presentation, plenary presentation

Quarter	Date	Stakeholders	Event/Recognition	Description	Source
		Manufacturers, EEPS			
2015 Q3	10-21-15	U.S. EPA	Meeting regarding Advanced Tier Setting	Conference call with PG&E, U.S. EPA and other stakeholder to discuss PG&E's perspective and analysis on technical specification for the ESRPP advanced tiers. PG&E presentation entitled, "ENERGY STAR RPP Program: Defining Optional Advanced Tiers Discussion"	Meeting agenda, presentation
2016 Q2	2-4-16	EEPS, EE implementers, manufacturers, retailers	AESP Annual Meeting	Members of ESRPP team participated in closing session at AESP to review RPP. Meetings with potential program participants.	Abstract
2016 Q2	4-1-16	U.S. EPA, ENERGY STAR Retail Action Council, EEPS	RPP Pilot Launch	Inaugural participants - EEPS: PG&E, NEEA, SMUD, XCEL, ConEd, Efficiency Vermont, Focus on Energy, NJ Clean Energy Program; retailers: Best Buy, Home Depot, Sears; products: dryers, freezers, air cleaners, room air conditioners, soundbars.	Participation agreements, RPP Pitch Deck
2016 Q2	4-13-16	U.S. EPA, ENERGY STAR Retail Action Council, EEPS, Appliance and Consumer electronics manufacturers	ENERGY STAR Partner of the Year Meeting	Meetings during annual ENERGY STAR Partner of the Year event to recruit potential participants, discuss RPP concept with manufacturers, and conduct RAC review meeting of RPP.	
2016 Q2	4-13-16	EPA, NEEA, PG&E	Meeting	Introducing the concept of establishing Energy Star Most Efficient as the specification for basic Energy Star	Meeting agenda
2016 Q3	8-21-16	PG&E, EEPS,EE professionals, Evaluators, Regulators	2016 ACEEE Summer Study on Energy Efficiency in Buildings	Presentations to national audience. 3 RPP related papers: RPP design, RPP pilot and RPP evaluation.	Papers
2017 Q1	1-5-17	Appliance and Consumer electronics manufacturers	CES 2017	Interacted with manufacturers and informed them about plug-load energy efficiency programs and RPP's efforts to influence retailers. 3M, a TV component supplier, relayed this information to their business partners during CES because cost savings (or incentives) less than one dollar can influence the design of an energy efficient product and can impact its qualification as an ENERGY STAR product. LG, Samsung and Bosch recognized the potential benefits of participating in a national energy efficiency effort and extended offers to continue the conversation.	CES 2017 Trip Report

Quarter	Date	Stakeholders	Event/Recognition	Description	Source
2017 Q3	8-16-17	PG&E (Codes & Standards), U.S. EPA, U.S. DOE	Meetings	Separate meetings with EPA and DOE to discuss applications of RPP total category data as well as energy use data collected by PG&E in home tests and research, which can assist DOE and EPA in setting specifications and modifying test methods.	Meeting agendas
2017 Q3	9-13-17	Manufacturers, Retailers, Consumers, Governments, international organizations and agencies, Academia and Energy Efficiency Experts	EEDAL 2017	Presentation at California-hosted, international conference on energy efficient appliances entitled "Addressing Growing Plug-Load Energy Consumption with an Innovative Program Design – Results of the ENERGY STAR Retail Products Platform Pilot"	Conference paper
2017 Q3	10-23-17	U.S. EPA, ENERGY STAR Retail Action Council, Manufacturers, EEPS	ENERGY STAR Products Partner Meeting	RPP networking session, ENERGY STAR RAC marketing presentations to RPP sponsors, RPP marketing panel, PG&E/NEEA television planning session	Meeting agenda, presentations
2018 Q1	2-14-18	CPUC ED, Sears, Nationwide, Best Buy, Home Depot	RPP Retailer Q&A Session	PG&E hosted meeting with CPUC/ED and RPP retailers to overview current retail industry and to present marketing activities that support RPP.	Workshop presentations
2018 Q1	3-13-18	PG&E, U.S. DOE	Meeting with Director DOE Building Technology Office	Presented concept for integrated market transformation strategy that encompasses RPP and Codes & Standards. Integrated strategy is consistent with DOE BTO's mission for appliance standards and emerging technology.	Concept slide
2018 Q2	July 2018	AESP	Innovative EE Programs	PG&E RPP program recognized by AESP in their 2018 magazine as innovative option to address cost effectiveness issues.	"Strategies to Improve Cost Effectiveness in a Tight Environment", AESP Magazine, 2018 Issue.
2018 Q3	8-12-18	EEPS, EE professionals, Evaluators, Regulators	2018 ACEEE Summer Study on Energy Efficiency in Buildings	Presentations to national audience. RPP paper on market transformation.	Papers
2018 Q3	9-4-18	U.S. EPA, ENERGY STAR Retail Action	ENERGY STAR Products Partner Meeting	ENERGY STAR RAC marketing presentations to RPP sponsors, RPP marketing panel	Meeting agenda, presentations

Quarter	Date	Stakeholders	Event/Recognition	Description	Source
		Council, Manufacturers.			
		EEPS			
2018 Q4	10-29-18	ASAP, ACEEE, PG&E, NEEA, appliance standards advocates, manufacturers	ASAP Steering Committee Meeting	Appliance Standards Assistance Project (ASAP) annual advisory group meeting formulates recommendations for revisions to appliance standards and test methods. Meeting included breakout session for next generation of home appliance standards including discussion of RPP total category data and potential application to standard setting.	Meeting agenda

APPENDIX F: PROGRAM LOGIC MODEL DEVELOPMENT

Several changes to PG&E ESRPP Program Pilot operations have occurred since the program began operating in 2016. These lessons have necessitated changes to the evaluation approach, and have led to several revisions to the original program logic model. We provide some additional details regarding these revisions below, and show the evolution of the original logic model to the proposed logic model moving forward.

Key changes that informed the development of a new logic model include the following:

- Overall program operations have been more fluid than initially envisioned, with a number of interactions occurring between elements in the program logic model. In the revised logic model (shown below in Figure F3) used for this evaluation research, these interactions are depicted by placing elements within dotted lines, rather than creating arrows from each element to the other. This depiction represents that within a dotted box, each element may potentially impact all other elements, resulting in a non-linear set of effects.
- During the early phases of program design, participating retailers were expected to commit to creating and implementing Retailer Implementation Plans ("Plans") for increasing the sales of energy-efficient models in the targeted product categories. These Plans would then serve as a tool to understand how retailers were using incentive dollars to drive sales of program-qualified units. In the course of this evaluation, it became clear that the Plans provided by retailers did not contain the level of detail initially expected by evaluators, and that there is no mechanism to obtain more-specific Plans. To address this, the evaluation approach has shifted slightly to place more weight on data collected from retailer store locations during in-store field visits by the PG&E ESRPP field services team.
- While the importance of the full category sales data collected from participating retailers has always been recognized, this pathway of influence within the program theory has become even more critical as our research has shown that such data simply does not exist elsewhere for the majority of the product categories included in ESRPP. As a result, the revised logic model more clearly emphasizes the importance of this data to the program's ability to facilitate the development of specifications, codes, and standards (this is represented by the right-most column in the revised model).

In the three figures below, we provide a graphical representation showing the original logic model, a mapping between the original logic model and the revised logic model itself.



Figure F1. Original Program Logic Model



F-2





* Note: M3 is a new node added to the revised logic model (with no analog in the original model), relating to the ability of ESRPP to achieve national scale necessary to influence retailer decisions. S2 in the new logic model has no direct analog in the original logic model.

Figure F3. Revised Logic Model



Key: ----- Dashed lines denote multiple interactions between elements inside (i.e., arrows connecting all elements).

External Influences:

Broad economic conditions, market events, cost of energy, federal standards, ENERGY STAR, perceived need for conservation, and possible others.

Note: Factors can influence the program at all levels and time frames.



APPENDIX G: DETAILED INFORMATION ON ENERGY STAR SPECIFICATION ADVANCEMENT TRACKING

In this appendix, we provide detailed information on the tracking of logic model element M4: "ENERGY STAR specification criteria for product categories becomes more stringent." To assess progress toward this goal, we recommend using the market transformation indicator "percent progress toward ENERGY STAR specification revision" using the graphics shown below for air cleaners and soundbars. The percent progress metrics shown here (actual as of mid-2018 and projected for PY3) represent PG&E estimates of progress toward the next specification revision.



Product Category: Room Air Cleaners

The Energy Star Air Purifier Version 2.0 specification is open for revision as of October 2018 due in part to ESRPP's actvities, including meeting with ESRPP market actors (epecially the EPA), submitting comments on guides, and providing insights from ESRPP program market data. Version 2.0 Draft 1 Specification is scheduled to be released for comments December 2018. PG&E and NEEA ESRPP analysis also identified a need to investigate why the smaller air cleaners are less efficient.

ENERGY STAR Room Air Cleaners Revision History



PG&E ESRPP Activities Related to ENERGY STAR Room Air Cleaners Revisions



Progress towards Next Version



Product Category: Sound Bars

There are no federal or state standards for soundbars. PG&E ESRPP is advocating for a specification revision that makes efficiency more transparent by improving categorizations of soundbars to better reflect actual sales and by improving measurement and reporting of energy consumption, particularly for active-mode.



PG&E ESRPP Activities Related to ENERGY STAR Sound Bars Revisions



APPENDIX H: RECOMMENDATIONS IN STANDARD IESR FORMAT

Item #	Page #	Findings	Best Practice / Recommendations (Verbatim from Final Report)	Recommendation Recipient
1.1	56	The PG&E ESRPP Program Pilot has implemented key activities necessary for the program to operate effectively, but impacts vary by product category. This reinforces the need for the program to have product category-specific strategies and goals that can be tracked and periodically reevaluated. It also suggests that not all product categories may be suitable to include in the ESRPP program.	Continue to develop product category-specific strategies and targets that are tailored to each product. Additionally, for product categories where an increase in market share is not the primary objective, make sure that another objective has been identified and is clearly documented. For instance, there may be products where the primary objective is to help advance ENERGY STAR specifications. In these cases, there should be a specific need that ESRPP can address (for instance, by providing full-category sales data). To ensure that credit is given to PG&E, it is critical to document the impacts that these data have on subsequent developments for specifications, codes, or standards.	PG&E
1.2	56	The PG&E ESRPP Program Pilot has implemented key activities necessary for the program to operate effectively, but impacts vary by product category. This reinforces the need for the program to have product category-specific strategies and goals that can be tracked and periodically reevaluated. It also suggests that not all product categories may be suitable to include in the ESRPP program.	Product categories for which we have not yet observed an increase in sales or assortment share should be closely monitored to ensure they are making reasonable progress toward the objective for that product category. For some product categories, the value of obtaining full category sales data from retailers may provide substantial benefit to PG&E efforts to advance specifications, codes, and standards. In these cases, there is an argument for keeping these product categories in the program, assuming that the relevant sales data can be used to advance voluntary or mandatory requirements (see Recommendation #1.1 above). It may be prudent to make downward adjustments to the incentive amounts for these product categories to reflect this strategy.	PG&E

Item	Page	Findings	Best Practice / Recommendations	Recommendation
#	#		(Verbatim from Final Report)	Recipient
3.1	56- 57	National ESRPP program processes could be improved by adopting a simplified approach for defining tiers within a product category and, to the extent possible, aligning these tiers with ENERGY STAR requirements. An important feature of the ESRPP program design is the ability to "ratchet up" tier requirements as program-qualified share increases for these product categories. To date, the ESRPP collaborative has used a flexible method in which tier eligibility requirements are aligned annually with ENERGY STAR specifications except in cases where the market share for that product category is already high. In these cases, the tier requirements have been set to "ENERGY STAR + XX%" (where the precise percentage varies based on the current program-qualified market share). This is a necessary adjustment for the program to make. However, in some cases it has caused logistical difficulties for the program and for retailers because it becomes more difficult to determine which models actually qualify for each tier.	In the future, PG&E should work with other program sponsors to explore simplifying the qualifying requirements used for the national ESRPP program and, to the extent possible, keeping these qualifying requirements aligned with ENERGY STAR definitions. For instance, ESRPP could choose to align qualifying requirements with ENERGY STAR Most Efficient (ESME) in categories where there is such designation. In categories that lack ESME, there may be value in working with the EPA to establish such a designation.	PG&E

PG&E ESRPP Program Pile	t Evaluation - Appendices
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Item #	Page #	Findings	Best Practice / Recommendations (Verbatim from Final Report)	Recommendation Recipient
4.1	57	The full category sales data provided by participating retailers are a valuable tool, particularly for facilitating the development of specifications, codes, and standards. Interviews with external collaborators indicate that these data have already been used to facilitate the development of ENERGY STAR specifications. Further research has revealed that these data do not exist anywhere outside of the ESRPP efforts, making it an even more valuable resource.	Given the long-term program goals of changing mandatory and voluntary specifications, PG&E should continue to work with regulatory bodies to provide data and analysis to accelerate the adoption of these rules.	PG&E
6.1	58	As the PG&E ESRPP Program Pilot continues to operate moving forward, the current baseline approach (i.e., a pre/post model averaging baseline) will become less useful as the pre-period sales data become outdated. Therefore, it will become increasingly important to use a baseline approach that is able to account for new developments and external changes in the market.	Moving forward, the PG&E ESRPP Program Pilot should adopt a baseline approach similar to that employed by NEEA to help understand and assess market transformation effects due to the ESRPP program. There are several benefits of using a baseline approach similar to that utilized by NEEA: (1) the approach has already been in use for some time, (2) it is transparent and flexible, and (3) using such an approach would facilitate evaluation consistency across two of the most important ESRPP program sponsors.	PG&E