

PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

ENERGY DIVISION

Agenda ID: 18930
RESOLUTION E-5073
December 3, 2020

R E S O L U T I O N

Resolution E-5073. Approving with modifications Pacific Gas and Electric Company's Advice Letter 5731-E to implement the WatterSaver program to enable shifting of electric water heating load in compliance with Assembly Bill 2868 and D.19-06-032.

PROPOSED OUTCOME:

- Approves with modification, Pacific Gas and Electric Company's Advice Letter 5731-E.

SAFETY CONSIDERATIONS:

- There are no direct effects on safety. However, ratepayer-funded installation of heat pump water heaters that replace propane water heaters, and the installation of smart controls on existing electric water heaters, will lead to reductions of criteria air pollutants, specifically nitrogen oxides that contribute to air pollution and impact human health;

ESTIMATED COST:

- This Resolution will result in costs up to \$6,400,000, as approved in Ordering Paragraph 4 of Decision 19-06-032.
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SUMMARY

This Resolution approves, with modification, Pacific Gas and Electric Company's Tier 3 Advice Letter 5731-E and Supplemental Advice Letter 5731-E-A, requesting up to \$6,400,000 to create a new electric water heating thermal energy storage program called WatterSaver.

BACKGROUND

On September 26, 2016, Governor Jerry Brown signed Assembly Bill (AB) 2868 (Gatto, 2016)¹ into law, adding Sections 2838.2 and 2838.3 to the Public Utilities (PU) Code. PU Code Section 2838.2(b) summarizes the overarching goal of the legislation:

“The Commission, in consultation with the State Air Resources Board and Energy Commission, shall direct the state’s three large electrical corporations to file applications for programs and investments to accelerate the widespread deployment of distributed energy storage system to achieve ratepayer benefits, reduce dependency on petroleum, meet air quality standards, and reduce emissions of greenhouse gases. Programs and investments proposed by the state’s three largest electrical corporations shall seek to minimize overall costs and maximize overall benefits.”

On May 8, 2017, the CPUC issued Decision (D.) 17-04-039, directing the three large electrical investor-owned utilities (IOUs) to “incorporate proposals for programs and investments for up to 166.66 Megawatts (MW) of distributed energy storage (DES) systems into their 2018 energy storage procurement plans.”²

On March 1, 2018, Pacific Gas and Electric Company (PG&E) filed Application (A.) 18-03-001³ to show compliance with the requirements of 2838.2(b) and D.17-04-039.⁴ Included in its Application was a request from PG&E to proceed with

¹ For full legislative text see:

https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB2868.

² D.17-04-039, p.20.

³ A.18-03-001, available at:

<https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M211/K889/211889207.PDF>.

⁴ See D.17-04-030 at: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M185/K070/185070054.PDF>.

(1) an Energy Storage Request for Offer (RFO) in compliance with AB 2514⁵, (2) up to 166.66 megawatts (MW) procurement for four categories of distribution-connected storage investments in compliance with AB 2868,⁶ and (3) five MW procurement of behind-the-meter (BTM) thermal energy storage in compliance with AB 2868.

On June 27, 2019, the Commission adopted D.19-06-032,⁷ implementing the AB 2868 energy storage program and investment framework and approving AB 2868 applications with modification. In adopting the decision, the Commission denied PG&E's request for approval for its 166.6 MW procurement for distribution-connected energy storage and approved up to \$6,400,000 in funding for its BTM thermal energy storage program. The Commission directed PG&E to do the following as it related to the BTM thermal storage program:

- Ordering Paragraph (OP) 4 authorized PG&E "to move forward with its proposed Assembly Bill 2868 behind the meter thermal storage program by spending up to \$6.4 million during the period from 2019 to 2025, subject to filing a subsequent Tier 3 Advice Letter for final approval."⁸
- OP 5 authorized "the establishment of a Public Policy Balancing Account to record actual costs and revenues for the customer-

⁵ AB 2514 (Skinner, 2009) established energy storage procurement requirements for each electrical IOU and local publicly owned electric utility.

⁶ The four categories of distribution-connected storage investments included (1) deploying energy storage in the North Bay to improve fire resilience, (2) supporting local capacity requirement, (3) support reliability for customers in low-income and disadvantaged communities, and (4) support transportation electrification.

⁷ See D.19-06-032 at: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M309/K522/309522481.PDF>.

⁸ See D.19-06-032, p.93 at: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M309/K522/309522481.PDF>.

connected behind the meter Thermal Storage Program with recovery through the Public Purpose Program rate.”⁹

- OP 6 required PG&E, when filing their Tier 3 Advice Letter, to “inform the Commission of the specific actions it will take to prioritize public sector and low-income customers, and it must include an outreach plan to ensure that customers understand how their rates will change and what bill impact would have been based on historical usage.”¹⁰

D.19-06-032 also established cost-effectiveness guidance for AB 2868 projects, stating: “Given the weight of the evidence, the Commission agrees that the investor owned utilities must demonstrate cost effectiveness for the resulting procurement from AB 2868 to be considered reasonable, and thus recovered in rates.”¹¹ The Decision added that “the IOUs shall include a rigorous cost effectiveness showing in their new applications that includes the net present value, net market value and least cost, best fit cost calculations as part of their AB 2868 project proposals.”¹²

PG&E Advice Letter (AL) 5731-E – December 31, 2019

On December 31, 2019, PG&E filed AL 5731-E and proposed final program implementation details for the BTM energy storage program. The AL proposed “WatterSaver” as the program name and provided implementation details for the following six categories:

⁹ See D.19-06-032, p.93 at:

<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M309/K522/309522481.PDF>.

¹⁰ See D.19-06-032, p.94 at:

<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M309/K522/309522481.PDF>.

¹¹ D.19-06-032, P.56.

¹² D.19-06-032, p.56.

- Program Implementation Team
- Marketing, Education, and Outreach Strategy
- Energy Management System
- Program Incentives
- Data and Reporting
- Proposed Measurement and Verification Framework

Each program implementation category is summarized below.

Program Implementation Team

The program implementation team was selected through a Request for Proposal prior to AL submission in December 2019. The winning team, described as the WatterSaver team” consist of the Association for Energy Affordability (AEA), Energy Solutions (ES), and Virtual Peaker. Together this team has years of combined experience implementing programs on the ground, coordinating with supply chain actors, and leveraging software expertise to execute the WatterSaver program.

Marketing, Education, and Outreach (ME&O) Strategy

The proposed program ME&O strategy consisted of a five-prong approach that included the following:

1. Identifying customers with existing Heat Pump Water Heaters (HPWHs), and Electric Resistance Water Heaters (ERWHs) through existing programs being implemented by one of the WatterSaver implementation team members.
2. Coordination with mid-stream HPWH incentive programs to develop a program pipeline of eligible customers.
3. Coordination with external programs being implemented throughout PG&E’s service territory including, California Alternate Rates for Energy (CARE), Energy Saving Assistance (ESA) Program, Energy Efficiency (EE) programs, and the Low-Income Weatherization

Program (LIWP) administered by the California Department of Community Services & Development.

4. Educating customers on the program's required time-of-use (TOU) rate enrollment and associated bill impact.
5. Development of program collateral that can be presented in a variety of forums for program enrollment.

Energy Management System

The AL states that the "WatterSaver program will communicate with smart devices multiple times per minute receiving real-time data back on key variables including, mode, tank temperature, and setpoint."¹³ This information will be used in conjunction with a required TOU rate to heat "water at the lowest-cost time period while ensuring that the customer doesn't receive a cold-water event."¹⁴

The Energy Management System could also be used to respond to additional control strategies, including:

- Event-based load shifting, where water is preheated during a desired time and the water heater remains off during the event window;
- Fixed scheduled, where a set charge/discharge schedule for a group of water heaters is set and can be updated by utility, as needed; and
- Energy arbitrage-based dispatch, where the water heater uses the locational marginal price (LMP) from a local Independent System Operator (ISO), such as the California Independent System Operator (CAISO), to "charge" the water heater when the price of energy is low and "discharge" when the price is high.

Program Incentives

¹³ AL 5731, p.7.

¹⁴ AL 5731, p.7.

PG&E proposes to provide separate pay-for-performance incentive for residential and small commercial participants. The residential incentive would be structured as a “one-time enrollment incentive per controlled water heater in the form of a prepaid gift card,” and a fixed performance incentive per month for allowing the “3rd party to control their water heater.”¹⁵ The residential incentive would be in addition to any savings provided by shifting load based on the TOU rate the residential customer would be required to be enrolled in. The commercial incentive would be a direct incentive check issued “every 6 months based on their participation in the program.”¹⁶ The commercial incentive would be in addition to any savings provided by shifting load based on the TOU rate the commercial customer would be required to be enrolled in.

Data and Reporting

PG&E proposes to leverage the Energy Management System to report a series of data points on the electric water heaters enrolled in the WatterSaver program, as well as a series of Key Performance Indicators (KPIs) including, the following:

1. Enrolled Thermal Energy Storage Peak Demand Capacity (MW)
2. Enrolled Thermal Energy Storage Capacity (MWh)
3. Targeted Customer Segment Enrollments (#/segment)
4. Program Cost-Effectiveness (Program \$/Gross kW shifted; Program \$/Gross kWh shifted)
5. Controlled Residential and Commercial HPWHs (CTA-2045, WiFi)
 - Subtotal Control, Application Programming Interface (API) cost, and Mixing Valve Costs per Gross KW and per Gross kWh
6. Controlled Residential and Commercial ERWHs
 - Subtotal Control + API Costs, and Mixing Valve Costs per gross kW and per gross kWh

¹⁵ AL 5731-E, p.8.

¹⁶ AL 5731-E, p.8.

7. Customer TOU Cost Savings (Gross and Average per customer)
8. Greenhouse Gas (GHG) Reduction (Average per customer and gross)
9. Air quality improvement
10. Petroleum reliance reduction (removal of propane water heaters)
11. Customer Satisfaction

Proposed Measurement and Verification Framework

To measure and verify the program impacts, PG&E proposes the following methodologies for calculating peak kW savings, load shift kWh savings, and reduction of petroleum reliance.

To calculate electricity demand (kW) and load shift energy (kWh) reductions, the AL proposes a methodology for establishing a baseline for an uncontrolled electric water heater. To accomplish this, the AL proposes to use industry research through programs like the Electric Program Investment Charge (EPIC), simulation appliance data, setting aside a sample of water heaters to serve as a constant baseline, or the creation of a “rolling” control group of unshifted water heaters. Once a baseline is established, the AL proposes to calculate average demand and energy savings during the five-hour TOU window that residential customers would be enrolled in. Commercial customers will have their baselines calculated on a custom baseline on a project by project basis.

PG&E’s analysis estimates that in a residential application:

- A controlled HPWH can reduce peak demand by 0.28 kW and can shift 0.67 kWh in comparison to an uncontrolled HPWH.
- A controlled ERWH can reduce peak demand of 0.55 kW and can shift 1.88 kWh in comparison to an uncontrolled ERWH.

The analysis also estimates that in a commercial application:

- A controlled HPWH can reduce peak demand by 1.40 kW and can shift 3.35 kWh in comparison to an uncontrolled HPWH.

- A controlled ERWH can reduce peak demand by 1.53 kW and can shift 5.64 kWh in comparison to an uncontrolled ERWH.

Based on these estimated figures, PG&E anticipates enrolling 6,400 residential HPWHs, 1,112 residential ERWHs, approximately 67 commercial HPWHs, and 28 commercial ERWH. This information is summarized in Table 1 from the AL.

	Controlled Units	kW/ unit	kWh/ unit	MW total	MWh/ day total	kg CO2e/ day/ unit⁵	Total kg CO2e/ Day	Estimated Bill Savings/ Unit/yr⁶	Estimated Bill Savings/ year
Residential HPWH	6400	0.28	0.67	1.79	4.29	0.27	1,759	\$30	\$192,000
Residential ERWH	1112	0.51	1.88	0.57	2.09	0.78	869	\$120	\$133,440
Commercial HPWH	67.2	1.40	3.35	0.09	0.23	0.82	55	\$150	\$10,080
Commercial ERWH	28	1.53	5.64	0.04	0.16	3.91	109	\$360	\$10,080
			TOTAL	2.50	6.76		2,793		\$345,600

Table 1: WatterSaver Program Benefits¹⁷

On January 21, 2020, the Small Business Utility Advocates (SUBA) and the California Public Advocates Office (Cal Advocates) filed protests to AL 5731-E. A summary of each protest is provided below:

Cal Advocates Protest – January 21, 2020

In its protest, the Public Advocates Office at the California Public Utilities Commission (Cal Advocates) requests that the CPUC require PG&E to demonstrate that its BTM thermal storage program is cost-effective and provide additional program details to demonstrate that the BTM storage program is reasonable. Cal Advocates cites D.19-06-032 and PU Code Section 2835 as justification for why PG&E must demonstrate program cost-effectiveness for its thermal storage program. Cal Advocates specifically cites the following sentence of D.19-06-032: "... the Commission agrees that the investor owned utilities must

¹⁷ AL 5731-E, p.8.

demonstrate cost effectiveness for the resulting procurement from AB 2868 to be considered reasonable, and thus recovered in rates.”¹⁸

Cal Advocates also noted in their protest the lack of program details filed in AL 5731-E. Specifically, they highlight that “PG&E has not provided: (1) the program’s incentive levels, (2) the specific time-of-use rate in which customers will be required to enroll, (3) the estimated bill savings for customers not already enrolled in a TOU rate, and (4) a demonstration of GHG emission reductions.” To remedy these issues, Cal Advocates requested that this information be provided prior to the CPUC’s final approval.

SUBA Protest – January 21, 2020

In its protest, the Small Business Utility Advocates (SUBA) identifies the following four areas of concern with AL 5731-E: (1) inadequate inclusion of small businesses in the thermal storage program, (2) a failure to clarify the program budget, (3) a poorly designed control approach with an inappropriate TOU rate, and (4) a lack of detail on program incentives for small business customers.

While SUBA states their support for the inclusion of small business customers in the WatterSaver program, they believe PG&E’s lack of commitment on a clear ME&O strategy and proposed enrollment of small businesses only in disadvantaged communities (DACs) will minimize enrollment. To remedy these identified issues, SUBA proposes revisions to PG&E’s outreach plan and the expansion of program eligibility to all small business customers, not just those located in DACs.

SUBA also believes that there is a lack of detail in AL 5731-E on the issues of (1) control strategies for small business participants, (2) incentive for small business participants, and (3) budget for small business to effectively evaluate

¹⁸ D.19-06-032, p.56.

the program. SUBA requests that PG&E clarify and provide details on that information to determine whether that program is useful and cost-effective.

Energy Division AL Suspension – January 22, 2020

On January 22, 2020, Energy Division staff issued an Initial 120 Day Advice Letter Suspension Notice effective January 31, 2020.

PG&E's Protest Response – January 28, 2020

On January 28, 2020, PG&E responded to Cal Advocates's and SUBA's protests of AL 5731-E. PG&E addressed the three major areas of concern raised by the parties including, (1) cost-effectiveness, (2) lack of program details, and (3) program commitment to small business customers.

On Cal Advocates' concern that the AL did not demonstrate WatterSaver's cost-effectiveness, PG&E believes that D.19-06-032 did not require a cost-effectiveness showing. PG&E states "Ordering Paragraph 4 and the Decision's approval of PG&E's BTM thermal energy storage program, did not require that PG&E demonstrate cost-effectiveness in its advice letter."¹⁹ PG&E also states that "the Decision evaluated the cost and benefits of the program and authorized the program subject to an overall cost cap of \$6.4 million, recognizing that the program is a pilot project, and that the \$6.4 million is reasonable and complies with AB 2868 cost and benefit requirements."²⁰

On Cal Advocates' and SUBA's concerns that the AL lacks the necessary program details to evaluate the program, PG&E says that it "understands that while the additional information requested by Cal Advocates and SUBA may be desirable at this stage of the program's development, they are not required for compliance with ordering paragraphs of D.19-06-032, which govern this behind

¹⁹ Pacific Gas and Electric Company's Reply to the Protest in AL 5731-E, p.1.

²⁰ Pacific Gas and Electric Company's Reply to the Protest in AL 5731-E, p.1.

the meter thermal storage program.”²¹ PG&E also notes that to provide the additional information requested, “PG&E requires commission approval of this advice letter,” and that “the initial phases of the program will be iterative while monitoring and responding to program outcomes in order to optimize success in meeting” the program’s various goals.²²

Finally, in response to SUBA’s concerns about the program’s commitment to small business customers, PG&E states that they agree “with the Commission’s determination in D.19-06-032 to not adopt a carve out for small businesses,” and “appreciates the suggestions that SUBA included in their protest, and will work with SUBA and other stakeholders to discuss these ideas on an appropriate program implementation that deploys energy storage projects for small businesses.”²³ PG&E also clarified that “SMB customers in all areas are eligible,” for the WatterSaver program.²⁴

Energy Division Further Suspension Notice – May 29, 2020

On May 29, 2020, Energy Division issued a Further Suspension Notice for AL 5731-E extending the suspension period an additional 180 days, until November 25, 2020.

Energy Division Supplemental Advice Letter Request – June 9, 2020

On June 9, 2020, Energy Division issued a Supplemental Advice Letter Request for AL 5731-E and requested that PG&E respond to 11 questions and comments about the program, including the following:

²¹ Pacific Gas and Electric Company’s Reply to the Protest in AL 5731-E, p.2.

²² Pacific Gas and Electric Company’s Reply to the Protest in AL 5731-E, p.2.

²³ Pacific Gas and Electric Company’s Reply to the Protest in AL 5731-E, p.3.

²⁴ Pacific Gas and Electric Company’s Reply to the Protest in AL 5731-E, p.3.

1. Does the WatterSaver program intend to provide appliance incentives for the replacement of propane and electric resistance water heaters? If appliance incentives are to be offered for those individual technologies, please provide incentive amounts.
2. What will the one-time enrollment incentive and monthly performance incentive amounts offered to residential customers be?
3. How will small commercial participant incentives be calculated?
4. Please specify with residential Time-of-Use (TOU) rate customers will be required to enroll in to participate in the WatterSaver program.
5. Based on the required TOU rate for residential customers, calculate the estimated bill savings, including program performance incentive payments for the projected number of both HPWHs and electric resistance water heaters in the program.
6. How will residential and commercial customers on an existing TOU or Electric Vehicle (EV) rate enroll in the program?
7. Update the Measurement and Verification chart on page 8 of the AL to reflect any appliance incentives offered through the program, the updated residential customer bill savings, as well as any program performance incentives.
8. Provide a program budget that, at a minimum, shows program incentive costs, outreach and education costs, and program administration costs.
9. WatterSaver proposes to leverage existing programs to enroll HPWHs at an expedited rate. Energy Division appreciates this strategy but has concern over how “leveraged programs” will claim program attribution. Please explain the WatterSaver team’s approach to tracking any leveraged program attribution, including projected energy savings.
10. Please explain if the WatterSaver program will utilize any additional control strategies besides the daily Time-Of-Use (TOU) shifting strategy identified in the advice letter.
11. Please provide a cost effectiveness showing for the WatterSaver program. The cost effectiveness showing should quantify the participant and utility benefits of the program and include any modifications made in response to questions asked in this supplemental advice letter request.

On June 19, 2020, PG&E filed Supplemental Advice 5731-E-A responding to Energy Division's questions and comments for clarification. A summary of PG&E's responses is provided below:

Program Incentives

PG&E clarified that the WatterSaver program will not provide an appliance incentive to retrofit ERWHs as originally proposed in their application. PG&E will provide an appliance incentive to replace 100 propane water heaters (PWH) with HPWHs. PG&E targets to replace 75 PWHs in low-income households with a \$2,000 incentive and 25 PWHs in market rate households with a \$1,000 incentive.

PG&E clarified the initial value of the performance incentive offered to residential customers. "Residential customers will receive a \$50 incentive at time of enrollment," and "for each month residential customer continues to satisfactorily participate in the program they will receive a participation incentive of \$5/mo[nth]." ²⁵

PG&E clarified that there will be no enrollment incentive provided to commercial customers and estimated that the participation incentive would be "approximately \$7/month for water heaters with a maximum input capacity of less than 10 kW and approximately \$15/month for water heaters with a maximum input capacity of 10 kW or more." ²⁶

Incentive payments for both residential and commercial customers would be paid in a frequency of every three or six months.

Program TOU Rates and Estimated Utility Bill Savings

²⁵ Supplemental AL 5731-E, p.2.

²⁶ Supplemental AL 5731-E, p.3.

In response to Energy Division's comment asking PG&E to specify the TOU rate residential customers would have to enroll, PG&E states that "E-TOU-C rate schedule will be required for eligible customers receiving either PG&E bundled rate and unbundled electric service."²⁷ PG&E also clarified that residential customers "who already receive service through a PG&E time varying rate (including any existing PG&E TOU and Electric Vehicle Customers [EV] rates) and those customers who will be dual participants in the San Joaquin Valley Electrification pilot programs," would be able to remain on those specialized rates.

Based on the designation of the E-TOU-C rate as the required TOU rate for the WatterSaver program, PG&E also calculated an estimated bill savings for residential customers using both HPWHs and ERWHs. Program participants who enroll with a HPWH "may not impact customer bills positively or negatively in the absence of any customer changes as a result of TOU education."²⁸ Program participants who enroll with an ERWH can expect a "minimal increase in overall daily kWh consumption, annual utility bill cost reductions of approximately \$20/year."²⁹

Measurement and Verification Analysis Update

In response to Energy Division's request that the measurement and verification chart provided in AL 5731-E be updated to reflect the additional details requested, including the inclusion of an appliance incentive, estimated bill savings, program participation incentive, PG&E updated the chart to include following terms.³⁰

²⁷ PG&E AL 5731-E-A, p.3.

²⁸ PG&E AL 5731-E-A, p.4.

²⁹ PG&E AL 5731-E-A, p.4.

³⁰ The examples provided focus on residential ERWH for illustrative purposes, but were also calculated for residential HPWHs, commercial HPWHs and commercial ERWHs.

- “Estimated Bill Savings/Unit/Year (E-TOU-C)” is the annual estimated utility bill savings of the different electric water heating types for the different customers types using the E-TOU-C rate schedule and pricing. For example, one residential ERWH is estimated to save a participating customer \$20 per year.
- “Estimated Bill Savings/Year” is the annual estimated utility bill savings by electric water heating type. For example, the projected 1,112 residential ERWHs enrolled in the program are estimated to save participating customers a total of \$22,240 per year in aggregate.
- “Average Customer Incentives Per Year” is the sum of the estimated utility bill savings on a TOU-E-C rate schedule, the enrollment incentive provided for the program, if any, and the participation incentive provided to the customer. For example, a residential ERWH customer’s estimated average incentive per year is \$72.50.

The updated chart, including the new terms, is summarized in Table 2.

Pacific Gas & Electric AL 5731-E/NK2

	Controlled Units	kW/ unit	kWh/ unit	MW total	MWh/ day total	kg CO2e/ day/ unit	Total kg CO2e/Day	Estimated Bill Savings/ Unit/ yr (E- TOU-C)	Estimated Bill Savings/ year	Average Customer Incentives Per Year
Res HPWH Load Shift	6400	0.28	0.67	1.79	4.29	0.27	1,759	\$0	\$0	\$72.50
Res ERWH Load Shift	1112	0.51	1.88	0.57	2.09	0.78	869	\$20	\$22,240	\$72.50
Com HPWH Load Shift	67.2	1.40	3.35	0.09	0.23	0.82	55	\$0	\$0	\$132
Com ERWH Load Shift	28	1.53	5.64	0.04	0.16	3.91	109	\$60	\$1,680	\$132
			TOTAL	2.50	6.76		2,793		\$23,920	

Table 2: Updated WatterSaver Measurement & Verification Chart³¹

Program Budget

In response to Energy Division's request for a program budget, PG&E provided the following chart breaking down the WatterSaver program's \$6,316,996 budget into four distinct categories, as shown in Table 3.

Administrative	\$447,218
Marketing	\$606,630
Direct Implementation Non-Incentives	\$2,124,956
Incentives	\$3,138,192
Total Program Budget	\$6,316,996

Table 3: WatterSaver Program Budget³²

³¹ AL 5731-E-A, p.4-5.

³² AL 5731-E-A, p.5.

In the AL 5731-E-A, PG&E defines each category as follows:

- Administrative and Marketing costs align with traditional CPUC definitions;
- “Direct Implementation Non-Incentives includes overall program design and implementation, customer enrollment and support, coordination with non-WatterSaver heat pump water heater installation and rebate programs, and load shifting software, management, analysis, and technical services; and
- “Incentives are inclusive of customer enrollment and participation incentives, propane to heat pump appliance incentives, program provided material and labor subsidies for mixing valves and water heater control hardware, and control communication protocol costs.”³³

Cost-Effectiveness Analysis

In Supplemental AL 5731-E-A, PG&E completed a cost-effectiveness analysis for three sub-programs, using two different scenarios. The three sub-programs reflect the three different technologies eligible to participate in the WatterSaver program (ERWHs, HPWHs, PWHs). The two different scenarios reflect two different lengths of time to account for the program’s benefits and costs. Scenario One accounts for benefits and costs over a ten-year program period, with continued program participation of approximately 80% after the program ends in year five. Scenario Two accounts for benefits and costs over the originally approved five-year program period. The cost-effective analysis completed by PG&E included the following variables: (1) Program Costs, (2) Participant Costs, (3) Program Benefits, and (4) Participant Benefits, and is based on “existing analyses available in the California Standard Practice Manual (SPM), but is currently a trial evaluation methodology developed for the WatterSaver

³³ AL 5731-E-A, p.5.

program.”³⁴ PG&E’s definition of each variable for each technology sub-program and its associated value is briefly explained below.

ERWH Sub-Program Cost-Effectiveness Analysis

The ERWH sub-program total estimated program costs are \$1,306,083. This cost total breaks down into the following budget category amounts: \$63,356 for administration, \$89,495 for marketing, \$307,437 for direct implementation non-incentives, and \$575,796 for incentives.

The ERWH sub-program participant costs are \$0.

The ERWH sub-program total estimated program benefits are equal to the net value of the avoided costs achieved when comparing an uncontrolled ERWH load curve against a controlled, or load-shifting, ERWH load curve.

The estimated net avoided electricity system value, or program benefits, using the 2019 avoided cost calculator (ACC) are \$707,530 over a five-year program period and \$2,305,981 over a ten-year program period.

The two load curves compared by PG&E are visually represented in Figure 1 below.

³⁴ AL 5731-E, p.7.

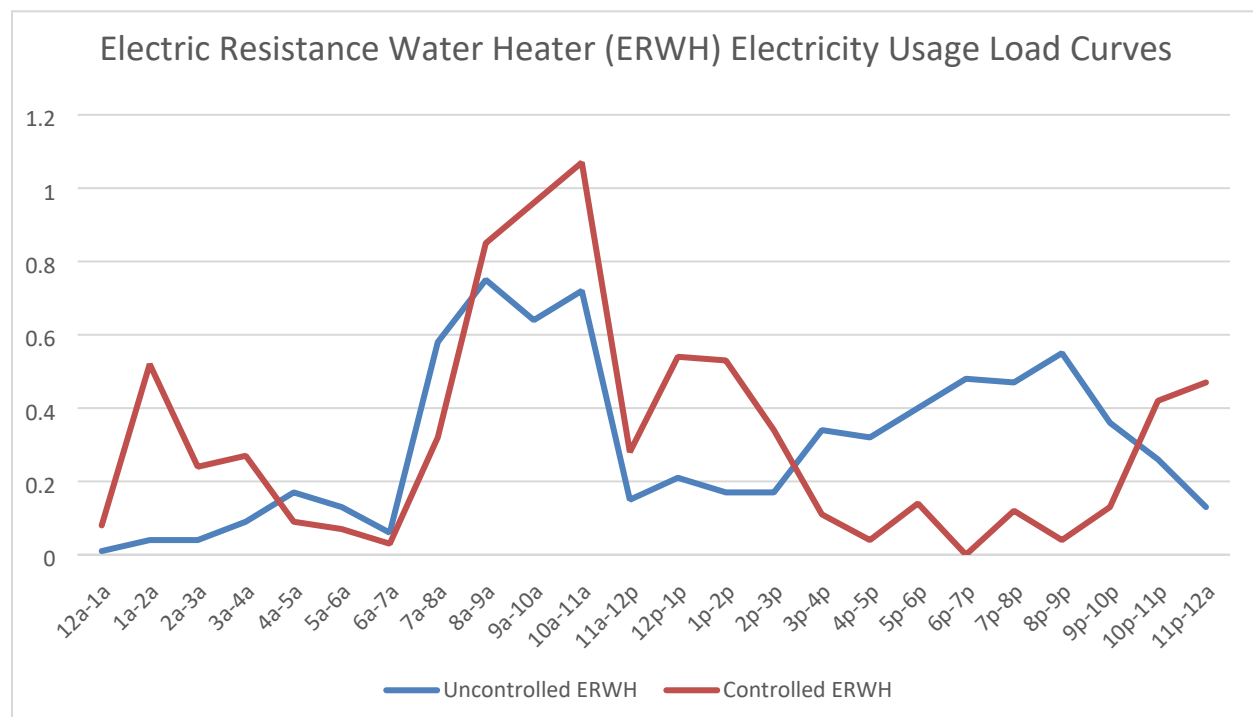


Figure 1: Comparison of an uncontrolled ERWH and a controlled ERWH³⁵

The ERWH sub-program participant benefits are equal to the sum of the electricity bill savings generated from shifting electricity usage from peak to off-peak periods and the pay-for-performance incentives provided to a program participant.

For the residential ERWH sub-program, the estimated annual electricity bill savings is \$20, and the estimated annual customer pay-for-performance incentive value is \$72.50. As such, the estimated annual participant benefit for a residential ERWH program participant is \$92.50.

For the commercial ERWH sub-program, the estimated annual electricity bill savings is \$60, and the estimated annual customer pay-for-performance incentive value is \$132. As such, the estimated annual participant benefit for a commercial ERWH program participant is \$182.

³⁵ PG&E response to Energy Division's request.

PG&E did not include the ERWH sub-program participant benefits in their cost-effectiveness analysis.

HPWH Sub-Program Cost-Effectiveness Analysis

The HPWH sub-program total estimated program costs are \$4,856,441. This cost total breaks down into the following budget category amounts: \$350,569 for administration, \$495,203 for marketing, \$1,701,151 for direct implementation non-incentives, and \$2,309,518 for incentives.

The HPWH sub-program participant costs are \$0.

The HPWH sub-program total estimated program benefits are equal to the avoided costs achieved when comparing an uncontrolled HPWH load curve against a controlled, or load-shifting, HPWH load curve. The estimated net avoided electricity system value, or program benefits, using the 2019 ACC are \$1,154,726 over a five-year program period and \$3,945,330 a ten-year program period.

The two load curves compared by PG&E are visually represented in Figure 2 below.

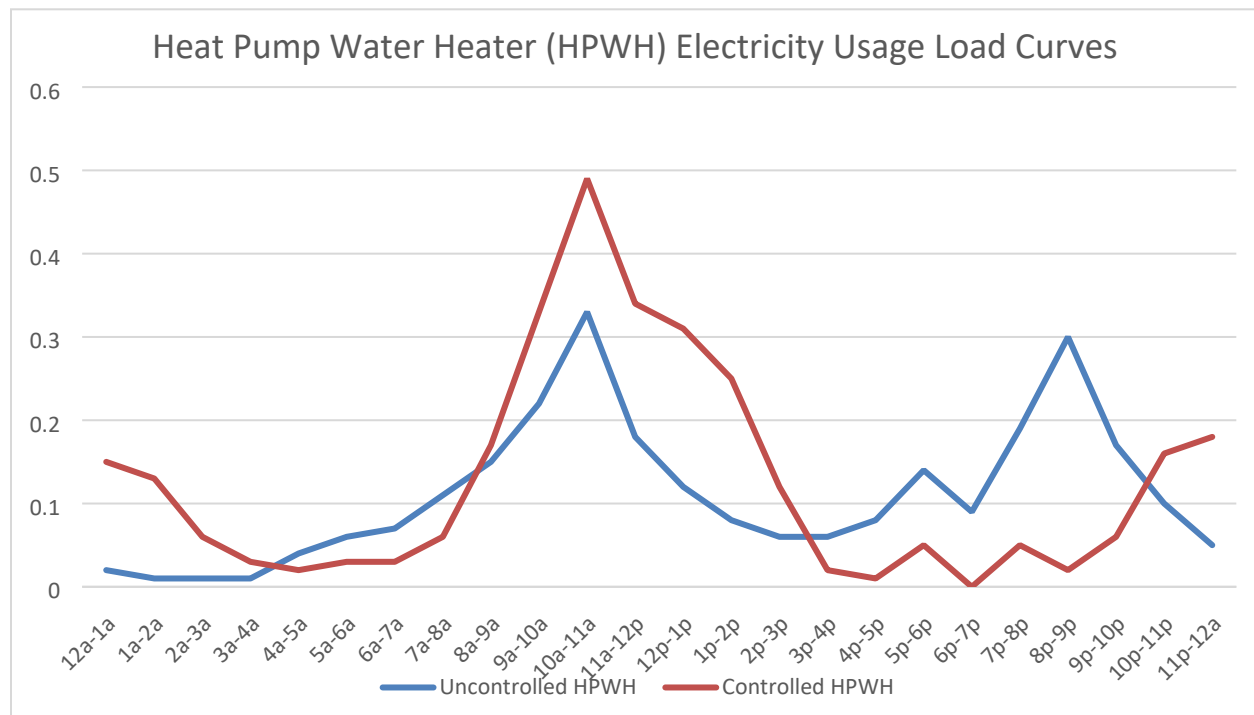


Figure 2: Comparison of an uncontrolled HPWH and controlled HPWH.³⁶

The HPWH sub-program participant benefits are equal to the sum of electricity bill savings generated from shifting electricity usage from peak to off-peak periods and the pay-for-performance incentives provided to a program participant.

For the residential HPWH sub-program, the estimated annual electricity bill savings is \$0, and the estimated annual customer pay-for-performance incentive value is \$72.50. As such, the estimated annual participant benefit for a residential HPWH program participant is \$72.50.

For the commercial HPWH sub-program, the estimated annual electricity bill savings is \$0, and the estimated annual customer pay-for-performance incentive value is \$132. As such, the estimated annual participant benefit for a commercial HPWH program participant is \$132.

³⁶ PG&E response to Energy Division's request.

PG&E did not include the HPWH sub-program participant benefits in their cost-effectiveness analysis.

PWH Sub-Program Cost-Effectiveness Analysis

The PWH sub-program total estimated program cost is \$462,772. This total cost breaks down into the following budget category amounts: \$33,293 for administration, \$21,993 for marketing, \$116,368 for direct implementation non-incentives, and \$252,879 incentives.

The PWH sub-program participant costs are the incremental costs a participant incurs to upgrade their existing PWH to smart control enabled HPWH. For example, if the total cost of replacing an existing PWH with a smart control enabled HPWH is \$2,500, and the WatterSaver program provides incentives valued at \$2,500, the participant cost is \$0.

PG&E anticipates that only the 50 market-rate participants of the total 125 targeted PWH participants will incur incremental costs to participate in the WatterSaver program. PG&E estimates the incremental costs a PWH market-rate participant will incur is \$765, after receiving a \$1,000 appliance incentive. As such, the total estimated participant costs for the PWH sub-program is \$38,250.

The PWH sub-program estimated program benefits consist of two components. The first component is the net value of avoided costs associated with the electrification of the existing PWH. The second component is the avoided costs when comparing an uncontrolled HPWH load curve against a controlled, or load-shifting, HPWH load curve. When summed together PG&E, estimates the PWH sub-program benefits over a 5-year period is -\$95,660 and over a 10-year period is -\$138,709 using the 2019 ACC. The program benefit values are negative in both scenarios due to the increased load and associated costs incurred by the electricity system.

The PWH sub-program estimated participant benefits consist of two components. The first component is the value of energy savings provided to a

participant. On an annual basis, PG&E estimates the value of propane use saving is \$465, and the value of electricity use is -\$318.³⁷ As such, the annual estimated value of energy savings for one participant is \$147. The second component is the value of pay-for-performance incentives provided to a PWH sub-program participant. Like the residential ERWH and HPWH sub-programs, a PWH sub-program participant receives an annual pay-for-performance incentive of \$72.50. As such, the total participant benefits over a five-year period is \$137,187 and over a ten-year-period is \$274,375

Unlike the ERWH and HPWH sub-programs, PG&E did include a modified participant benefit value in their cost-effectiveness analysis for the PWH sub-program. This modified value only accounts for the reduction of propane usage. PG&E believes this participant benefit is appropriate to include for two reasons. First, there is no transfer of systems costs between regulated fuel sources in the PWH sub-program as propane is regulated separately from the gas and electricity that is provided by IOUs.³⁸ Second, unlike the total PWH sub-program participant benefits, the electricity systems costs and pay-for-performance incentives are already accounted for in the program costs budget category. For these two reasons, PG&E includes a participant benefit valued at \$290,625 over a five-year period and \$581,250 over a 10-year-period in their cost-effectiveness analysis.

The final cost-effectiveness calculations for each sub-program, as completed by PG&E, are shown in Table 3 below:

³⁷ The electricity use value is negative due to the electrification of the PWH and increased electricity consumption.

³⁸ Unlike private companies providing electricity and natural gas service, private companies providing propane service to residential households are not regulated by the CPUC unless that propane is provided via a distribution system serving 10 or more customers. See Chapter 4.1 of Division 2 of the PU Code for more information:

https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=PUC&division=2.&title=&part=&chapter=4.&article=

	ERWH Sub-Program Cost/Benefit Ratio	HPWH Sub-Program Cost/Benefit Ratio	Propane Electrification Sub-Program Cost/Benefit Ratio	Total Costs	Total Benefits	Total Cost/Benefit Ratio
Scenario 1: Program benefits extend for 10 years from installation date	2.22	0.80	1.07	\$6,355,246	\$ 6,693,851	1.05
Scenario 2: Program benefits extend only through the end of the approved program period	0.68	0.23	0.88	\$6,355,246	\$ 2,247,846	0.35

Table 4: WatterSaver sub-program and overall program cost-effectiveness analysis.³⁹

On July 10, 2020, Cal Advocates filed a protest to Supplemental AL 5731-E-A. PG&E responded to the protest on July 22, 2020.

Cal Advocates Supplemental AL Protest – July 10, 2020

In response to PG&E's Supplemental AL 5731-E-A, filed June 19, 2020, Cal Advocates filed a protest recommending that the Commission reject the AL, or modify the program as authorized under PU Code Section 2828.2(c)(1) to ensure compliance with AB 2868 and the requirements of D.19-06-032.

Cal Advocates' request to reject the AL is based on their belief that the WatterSaver program does not "minimize costs and maximize benefits and does not promote the widespread deployment of energy storage systems to achieve ratepayer benefits as required by AB 2868."⁴⁰ In the discussion section of their protest, Cal Advocates breaks down their argument into three topics: (1) the program's minimal bill savings, (2) PG&E's analysis showing the ratepayer benefits are less than ratepayer costs for the five-year implementation window, and (3) how the analysis changes when using the 2020 ACC to determine

³⁹ PG&E AL 5731-E-A, p.9.

⁴⁰ Cal Advocates' Protest to PG&E's Supplemental AL 5731-E-A, p.1.

program benefits, rather than the 2019 ACC. Each topic is summarized in detail below.

Minimal Bill Savings

Cal Advocates notes that “the energy storage management system will result in no bill savings for the 6,400 enrolled residential and 67 enrolled commercial HPWH participants,” that the ERWH bill savings will be approximately “\$20 to \$60 per unit,” and that for PWH customers, bill savings will be approximately “\$147 per unit, due entirely to fuel cost savings.”⁴¹

Lack of Ratepayer Benefits and 2020 ACC Update Impacts

Cal Advocates requests that PG&E’s cost-effectiveness analysis be recalculated based on the 2020 ACC⁴² approved by the Commission on June 25, 2020. The updated cost-effectiveness results completed by PG&E are summarized in Table 4 below.

⁴¹ Cal Advocates’s Protest to PG&E’s Supplemental AL 5731-E-A, p.5.

⁴² See: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M340/K054/340054558.PDF>.

2020 ACC Scenarios	ERWH Sub-Program Cost/Benefit Ratio	HPWH Sub-Program Cost/Benefit Ratio	Propane Electrification Sub-Program Cost/Benefit Ratio	Total Costs	Total Benefits	Total Cost/Benefit Ratio
Scenario 1: Program benefits extend for 10 years from installation date	1.44	0.44	0.27	\$6,355,246	\$ 3,755,832	0.59
Scenario 2: Program benefits extend only through the end of the approved program period	0.45	0.13	0.21	\$6,355,246	\$ 1,210,579	0.19

Table 5: WatterSaver Program and Sub-Program Cost-Effectiveness Analysis using the 2020 ACC Values⁴³

Cal Advocates notes that using either the 2019 ACC or the 2020 ACC, the WatterSaver program over the five-year implementation period has a cost-effectiveness ratio of less than 1.0. This means the program's benefits are less than the program's costs. Using the 2019 ACC, the five-year program has a cost-effectiveness showing of 0.35 and using the 2020 ACC the five-year program cost-effectiveness showing of 0.19.⁴⁴

Cal Advocates also notes that the WatterSaver program is "not cost-effective as required by D.19-06-032"⁴⁵ and highlight's PG&E's claim that lack of cost-effectiveness showing is justifiable due to need to encourage adoption of HPWHs, as the technology is considered "important to help California reach its

⁴³ Cal Advocates's Protest to AL 5731-E-A, p.7.

⁴⁴ Cal Advocates's Protest to PG&E's Supplemental AL 5731-E-A, p.5, p.7.

⁴⁵ Cal Advocates's Protest to PG&E's Supplemental AL 5731-E-A, p.1.

2030 and 2045 carbon reduction goals.”⁴⁶ Cal Advocates pushes back against this claim by pointing out the “numerous other ratepayer-funded programs that are concurrently promoting the adoption of HPWHs that can achieve [the state’s carbon reduction goals].”⁴⁷

To remedy the issues they flag, Cal Advocates provides two potential modifications to improve the program’s cost-effectiveness and compliance with AB 2868 requirements. The first proposed modification is to “implement a decentralized rather than centralized control [approach], with the same ratepayer benefits and reduced ratepayer costs.”⁴⁸ Cal Advocates notes that PG&E proposed to spend approximately \$2.1 million for the development and operation of the energy storage management system.”⁴⁹ The second proposed modification is to “eliminate the HPWH subprogram entirely, and re-allocate program funds to the ERWH sub-program,” to increase the ratepayer benefits provided by the WatterSaver program.⁵⁰

PG&E’s Supplemental AL Protest Response – July 22, 2020

PG&E requests that the Commission “reject PAO’s protests in full and provide final approval of the program.” In direct response to the issues identified by Cal Advocates, PG&E notes that it provided in prior submittals “necessary cost-effectiveness data and detailed customer benefits” for program evaluation, and that they do not believe any information provided in Cal Advocate’s protest “would warrant a reexamination of the Commission’s prior approval to move forward with the program.”

⁴⁶ Cal Advocates’s Protest to PG&E’s Supplemental AL 5731-E-A, p.8.

⁴⁷ Cal Advocates’s Protest to PG&E’s Supplemental AL 5731-E-A, p.8.

⁴⁸ Cal Advocates’s Protest to PG&E’s Supplemental AL 5731-E-A, p.9.

⁴⁹ Cal Advocates’s Protest to PG&E’s Supplemental AL 5731-E-A, p.5.

⁵⁰ Cal Advocates’s Protest to PG&E’s Supplemental AL 5731-E-A, p.9.

In response to Cal Advocates' claim that other ratepayer-funded programs can help California achieve its GHG reduction goals, PG&E notes, "It is unreasonable to compare the WatterSaver program with other programs such as the [Self-Generation Incentive Program], [Technology and Equipment for Clean Heating Initiative], and ESA since these programs focus on incentivizing adoption of HPWHs" and not the load-shifting performance of the units.

NOTICE

Notice of AL 5731-E was made by publication in the Commission's Daily Calendar. PG&E states that a copy of the Advice Letters was mailed and distributed in accordance with Section 4 of General Order 96-B.

PLEASE NOTE: Staff MUST check to see that Advice Letter was properly noticed and distributed.

PROTESTS

The protests by Cal Advocates and SUBA on AL 5731-E and the protest by Cal Advocates on AL 5731-E-A are summarized in the background section.

DISCUSSION

The Commission reviewed PG&E's AL filings and party protests, and finds that, with modifications, PG&E's proposed BTM program both achieves the goals of AB 2868 and enables the Commission to better understand the value that smart control-enabled electric water heaters can provide to California's electricity system long-term. In this Discussion section, we respond to party protests on the WatterSaver program's design and cost-effectiveness, and we provide directed modifications to PG&E.

Program Design – Program Details

Cal Advocates and SUBA each requested that the CPUC reject PG&E's WatterSaver program for a variety of reasons.

Both parties in their protests filed on January 21, 2020 raised concern that PG&E's AL filings did not have an appropriate level of program design details (incentive levels, TOU rate information, etc.) for Energy Division to evaluate the program's compliance with D.19-06-032. We agree that the level of program details provided in the Application, the Decision, and the initial AL were lacking in substantive details. In response to this lack of detail, Energy Division on June 9, 2020 requested additional program information to enable a comprehensive evaluation of the program. The additional details provided in the supplemental AL clarified many of the concerns raised by both parties, including:

- The program's budget;
- The program's energy storage control strategies;
- The incentive amounts to be provided to both residential and commercial customers;
- The estimated bill savings for program participants;
- The availability of an appliance incentive for propane customers; and
- The program's ability to reduce GHG emissions.

As such, we find this initial protest topic corrected. However, moving forward, Energy Division Staff should ensure that all future AB 2868 program proposals provide adequate details. Only proposals with adequate program design details and cost-effectiveness analysis will be approved by the CPUC prospectively.⁵¹

Program Design – Small Business Inclusion

Beyond the lack of detail provided in PG&E's initial AL filing, SUBA also protested on the grounds that the AL, is "half-hearted in pursuing the small-business component of this load-shifting opportunity."⁵² We find this claim to be untrue. In D.19-06-032, we made it clear that the approved program was not required to adopt a carve-out for small business, noting that "AB 2868 did not

⁵¹ A.20-03-002, et al. See Scoping Memo and Ruling:
<https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M343/K070/343070016.PDF>.

⁵² SUBA Protest to AL 5731, p.2.

call out specific requirements for small businesses to receive a portion of capacity authorized in this statute.”⁵³ The decision also states that “PG&E, and the other IOUs, are welcome to work with SUBA and other stakeholders to develop programs that deploy energy storage projects for small business provided the programs meet the requirements of law and Commission Decision.”⁵⁴ We find that PG&E, through proposed inclusion of approximately 100 HPWHs and ERWHs from the small business sector in the WatterSaver program, is in compliance with the guidance provided in D.19-06-032. Additionally, we are confident that this small deployment size will help verify the ability of commercial electric water heaters to meet the goals of AB 2868 and inform the record for future smart control-enabled commercial water heating programs that the Commission may have to consider in the future.

Program Minimal Bill Savings

Cal Advocates protests and requests that the WatterSaver program be rejected based on the program’s minimal bill savings. We find Cal Advocates’ claim about the program’s bill savings valid, but also misleading. As described by PG&E in AL-5731-E-A, the residential and commercial HPWH sub-program is the only sub-program that may not achieve any bill savings. The ERWH sub-program estimates an annual bill savings of \$20 for residential customers and \$60 for commercial customers. In addition to these bill savings, customers would also receive a participation incentive that averages in value of \$72.50 for residential customers and \$132 for commercial customers.

It is also important to note that these values are based on PG&E’s E-TOU-C rate, which has a small pricing differential between its peak and off-peak periods. In the summer from June to September the peak to off-peak period differential, not

⁵³ D.19-06-032, p.37.

⁵⁴ *ibid.*

taking into consideration any baseline credit, is \$0.063.⁵⁵ In the winter from October to May the peak and off-peak period differential, not taking into consideration any baseline credit, is \$0.018.⁵⁶ We find this rate design's small peak and off peak pricing differential, especially the winter pricing differential, to be the main cause of the minimal bill savings, not the overall program.

Program Cost-Effectiveness

Cal Advocates protests and requests that the WatterSaver program be rejected based on the program not being cost-effective. Cal Advocates raised this topic throughout the initial Application process and in its protests filed on January 21, 2020 and July 10, 2020.

Given the complex nature of cost-effectiveness and the topic being an issue raised in protest filings, we find it appropriate to provide some background information prior to making a determination as to whether or not the WatterSaver program is cost-effective.

Background on the Avoided Cost Calculator (ACC)

Before reviewing the various cost-effectiveness tests and how they are used in approving or denying programs, we first provide a brief overview of how the ACC is used to determine the avoided costs of distributed energy resource (DER) programs.

⁵⁵ According to PG&E's "June 1, 2020 to Present" electric rate filing, which has a Summer Peak Energy Charge (\$/kWh) of \$0.41333 and an Off-Peak Energy Charge of \$0.34989. Excel Sheet Cells G40-G41. See: https://www.pge.com/tariffs/electric.shtml#RESELEC_INCLUTOU.

⁵⁶ According to PG&E's "June 1, 2020 to Present" electric rate filing, which has a Winter Peak Energy Charge (\$/kWh) of \$0.26502 and an Off-Peak Energy Charge of \$0.29891. Excel Sheet Cells G42-G43. See: https://www.pge.com/tariffs/electric.shtml#RESELEC_INCLUTOU.

Initially established in 2005 with the adoption of D.05-04-024,⁵⁷ the ACC is a tool that estimates the hourly marginal costs of providing energy services that a utility could avoid by investing in a DER. Over the past 15 years, both the ACC and the policy requirements implementing it have evolved to increase accuracy of the model. The most important updates to the ACC in respect to the WatterSaver program were adopted by D.16-06-007 and D.20-04-010.

D.16-06-007 put in place overarching rules and processes related to the ACC, including: (1) an annual process and timeline for updating the ACC and (2) the requirement that all DER programs use the most recent ACC when calculating cost-effectiveness.

D.20-04-010 approved a series of major policy updates to the ACC, including the adoption of energy storage as the avoided resource for avoided generation capacity costs, instead of natural gas combined cycle gas turbine (CCGT) generators. In comparison to the 2019 ACC, the change from natural gas CCGT to energy storage dramatically increased the avoided generational capacity costs midday. These two policy changes, along with other updates less relevant to the WatterSaver program, were formally approved by the CPUC on June 25, 2020 via Resolution E-5077.⁵⁸

The ACC is a spreadsheet model that forecasts hourly avoided costs for 30 years. There are six primary avoided costs that relate to the provision of electric and natural gas service in California. These six primary avoided costs include: (1) generation capacity, (2) energy, (3) transmission and distribution capacity, (4) ancillary services, (5) GHG emissions, and (6) methane leakage.⁵⁹ The output of the model represents the sum of these six avoided marginal costs in any given

⁵⁷ See: http://www.calmac.org/events/D_05-04-051_w_Attachments.pdf.

⁵⁸ Resolution E-5077 See: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M340/K054/340054558.PDF>.

⁵⁹ D.20-04-010, 2020 Policy Updates to the Avoided Cost Calculator. See: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M334/K734/334734544.PDF>.

hour that a DER can avoid, in dollars per unit of energy. These hourly values are multiplied by the program's hourly energy savings to estimate the program's total overall benefits. To determine the cost-effectiveness of a given program or resource these program benefits are compared to the program's costs in different ratio.

Background on Cost-Effectiveness Tests

With an understanding of how the ACC is used to determine a program's avoided costs, next we review the various cost-effectiveness tests employed by the Commission. The California Standard Practice Manual (SPM)⁶⁰ describes several different cost-effectiveness tests, each using different perspectives, and the costs and benefits included in each test. D.19-05-019 determined that three of these tests should always be performed in cost-effectiveness analyses of distributed energy resource (DERs), and that the Total Resource Cost test is recognized as the primary test.

- Total Resource Cost (TRC) – Compares the total costs of the program, including both the participants' and the utility's program administrator's costs, to its avoided costs.
- Program Administrator Cost (PAC) – Compares the costs incurred by the program administrator (including incentive costs) to the program avoided costs.
- Ratepayer Impact Measure (RIM) – Measures the program's impact on customer bills or rates due to changes in utility revenues and operating costs caused by the program.

The CPUC sometimes uses a societal test, described in the SPM as a modification of the TRC that includes societal impacts (e.g. environmental, public health) and

⁶⁰ See:

https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy_-_Electricity_and_Natural_Gas/CPUC_STANDARD_PRACTICE_MANUAL.pdf.

uses a different (societal) discount rate. In D.19-05-019, the Commission adopted, for testing purposes, a societal test called the Societal Cost Test (SCT) that uses a societal discount rate, calculates the value of avoided GHG emissions using the social cost of carbon, and includes a value for avoided emissions of criteria pollutants which cause air pollution.

The SPM also defines a Participant Cost Test (PCT), which measures benefits and costs from the program participant's perspective. This test is occasionally used by the CPUC.

Background on Thermal Energy Storage Programs

In addition to understanding how the ACC determines avoided costs and the various cost-effectiveness metrics used by the CPUC, it is also important to understand how the tests have been applied to other CPUC-approved thermal energy storage programs in the past.

The first thermal energy storage program we review is the Demand Response (DR Permanent Load Shifting (PLS) program. The PLS program, which focused on shifting energy usage on a recurring basis, was first included in the DR portfolio on a pilot basis in 2007, as ordered in D.06-11-049. From 2007 until 2011, the PLS pilots resulted in approximately 20 MWs of load-shift capacity at a cost to the ratepayers of approximately \$24 million. The PLS program was approved without consideration of cost-effectiveness due to it being a pilot program.

In 2009, the CPUC adopted D.09-08-027 ordering the IOUs to complete a study examining "ways of expanding the availability of permanent load shifting."⁶¹ On December 1, 2010 the Statewide Joint IOU Study of Permanent Load Shifting, completed by Energy and Environmental Economics (E3) and StrateGen, was

⁶¹ See: D.09-08-027, p.243 See:

<https://docs.cpuc.ca.gov/PublishedDocs/PUBLISHED/GRAPHICS/165317.PDF>.

submitted to the CPUC.⁶² This study, as well as the lessons learned from the PLS pilot programs, helped inform the scale, appropriate incentive amounts, and cost-effectiveness analysis to be used if the CPUC decided to adopt a permanent program.

In 2012, the CPUC adopted D.12-04-045, approving PLS program rules and budgets for the 2012-2014 DR program cycle. Included in the adopted rules were clarification on PLS program cost-effectiveness and technology eligibility. On cost-effectiveness, D.12-04-045 clarified that the TRC may not be appropriate due to the “large capital investment on the part of the customer which is not captured accurately in the TRC,” and made the determination to “not rely upon the TRC” when reviewing of PLS programs for approval.⁶³ Instead of relying only upon the TRC, the CPUC determined that it was appropriate to look more holistically at the proposed PLS programs. On technology eligibility, D.12-04-045 made clear that PLS program incentive was only available to “mature thermal energy storage technology, and are therefore not eligible for incentive under the Self-Generation Incentive Program (SGIP).”⁶⁴ In an effort to further clarify the PLS program rules, incentive levels, and program cost-effectiveness, the CPUC ordered the IOUs to propose a standardized statewide set of program rules within 90 days of the decision, for Energy Division staff to seek party feedback on the rules, and for the agreed upon rules to be filed via Tier 2 Advice Letter for final approval.

On January 14, 2013, Southern California Edison (SCE), on behalf of the three large electric IOUs, filed AL 2837-E and the Statewide Permanent Load Shifting Program Design Proposal with Revised Cost-Effectiveness Analysis. The cost-effectiveness analysis for all the IOU PLS programs included all four of the main

⁶² Statewide Joint IOU Study of Permanent Load Shifting. See: <https://www.ethree.com/wp-content/uploads/2017/02/PLS-Final-Report-with-Errata-3.30.11.pdf>.

⁶³ D.12-04-045, p.148, p.151. See: <https://docs.cpuc.ca.gov/PublishedDocs/PUBLISHED/GRAPHICS/165317.PDF>.

⁶⁴ D.12-04-045, p.152.

cost-effectiveness tests: the TRC, PAC, RIM, and PCT. The design proposal, including, the cost-effectiveness framework, was formally adopted by the Commission via Resolution E-4586⁶⁵ effective January 14, 2013.

In 2014, in response to a Petition for Modification from the California Energy Storage Alliance, the CPUC adopted D.14-08-029. This decision clarified that “small thermal energy storage systems should not be categorized as “mature” technology and should until such time as the Commission develops a record on and specific criteria for “emerging” technology, be treated as “emerging” technology and thus not eligible for the Permanent Load Shifting Program.”⁶⁶ This modification was approved using the “emerging” technology definition adopted in the SGIP program in D.11-09-015.

In 2015, the CPUC adopted the 2015 DR Protocols in D.15-11-042, providing a framework that applies to “all demand response activities that have measurable load impacts for which the load serving entity is requesting budget approval.”⁶⁷ The Decision also recognized that the protocols “are not a good tool to measure the cost-effectiveness of the Permanent Load Shifting program.”⁶⁸

In 2017, the CPUC adopted D.17-12-003, updating the cost-effectiveness requirements for all DR programs and eliminating the PLS programs. In that Decision, the CPUC determined that it was appropriate to require DR programs to achieve “a TRC cost-effectiveness ratio of 1.0 for each program,” or provide the CPUC with “continuous progress reporting on the program with qualitative

⁶⁵ See: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M064/K944/64944612.PDF>.

⁶⁶ D.14-08-029, p.1. See: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M102/K414/102414712.PDF>.

⁶⁷ D.15-11-042, p.46. See: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M156/K099/156099197.pdf>.

⁶⁸ D.15-11-042, p.49.

and quantitative indicators in lieu of a 1.0 TRC ratio.”⁶⁹ The Decision also eliminated the PLS program due to a low cost-effectiveness showing, low customer participation, and a lack of project completion since 2012.

The second thermal energy storage program we review is SGIP. Initially established by D.01-03-073 in response to AB 970 (Ducheny, 2000), the SGIP evolved over time to focus on technologies that can accomplish the following objectives⁷⁰:

1. Increase deployment of distributed generation (DG) and energy storage systems to facilitate the integration of those resources into the electrical grid; improve efficiency and reliability of the distribution and transmission system; reduce GHG emissions, peak demand, and ratepayer costs; and provide for an equitable distribution of the costs and benefits of the program (PU Code Section 379.6(a)(1));
2. Limit eligibility for incentives to distributed energy resources that reduce GHG emissions (PU Code Section 379.6(b)(1)); and
3. Limit eligibility for incentives under the program to distributed energy resource technologies that meet all of these criteria:
 - (1) shifts onsite energy use to off-peak time periods or reduces demand from the grid by offsetting some or all of the customer’s onsite energy load, including, but not limited to, peak electric load; (2) is commercially available; (3) safely utilizes the existing transmission and distribution system; and (4) improves air quality by reducing criteria air pollutants (PU Section 379.6(e)).

In 2009, the CPUC adopted D.09-08-026, implementing a cost-effectiveness framework for the SGIP and other distributed generation (DG) technology programs. The framework specified that DG programs use the PCT, the TRC Test

⁶⁹ D. 17-12-003, p. 121. See:

<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M202/K275/202275258.PDF>.

⁷⁰ Hereafter, all references to code are to the Public Utilities Code, unless otherwise noted. See:

https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=379.6.&lawCode=PUC.

(including its variant, the societal test), and the PAC Test” to evaluate programs.⁷¹ In addition to these cost-effectiveness tests, the CPUC also acknowledged that “many of the initiatives supporting DG in California are fundamentally market transformation programs” and directed DG programs to “include a qualitative analysis of the market transformation effect of these DG programs.”⁷²

In 2011, the CPUC adopted D.11-09-015, implementing modifications to the SGIP and the requirements of SB 412 (Kehoe, 2009)⁷³. On the topic of cost-effectiveness, the Decision determined SGIP technology eligibility would be based only on GHG emissions reductions. The Decision also rejected Energy Division’s proposal to include an upfront cost-effectiveness test screening. The CPUC rejected the cost-effectiveness screening based on: (1) the hampering effect that the requirement could have on market transformation, (2) the challenges of administering a performance-based incentive, (3) inadequate cost data to model assumptions upon, and (4) the exclusion of GHG reducing technologies being contrary to legislative intent.⁷⁴

On the topic of technology program eligibility, D.11-09-015 also determined that a set of advanced or “emerging” technologies were eligible for an SGIP incentive and adopted a formal definition for emerging technologies. Technologies were considered emerging if “their first commercial installation is less than ten years prior to SGIP funding and if they meet program goals of GHG and peak load

⁷¹ D.09-08-026, p.3. See: https://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/105926.pdf.

⁷² D.09-08-026, p.4.

⁷³ See: http://leginfo.ca.gov/pub/09-10/bill/sen/sb_0401-0450/sb_412_cfa_20090417_154423_sen_comm.html.

⁷⁴ D.11-09-015, pp.11-13. See: https://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/143459.PDF.

reduction.”⁷⁵ Included under this definition was Advanced Energy Storage, including, standalone thermal energy storage.

In 2019, the CPUC adopted two Decisions related to thermal energy storage. The first, D.19-08-001,⁷⁶ required thermal energy storage to meet the same GHG reduction requirements as electrochemical storage and categorized HPWHs as thermal energy storage. The second, D.19-09-027,⁷⁷ further clarified that HPWHs qualify for SGIP as thermal energy storage due to the technology’s ability to load-shift. The second Decision also established a \$4 million equity budget for HPWHs.

In 2020, the CPUC adopted D.20-01-021⁷⁸, approving an additional \$40.7 million HPWH budget for general market customers and directing Energy Division staff to host a workshop on new program rules. Accordingly, on March 19, 2020, and May 7, 2020, Energy Division staff held workshops on how to incorporate HPWHs into the SGIP. These workshops covered a range of topics related to HPWHs in the SGIP, including, how the technology could shift load from peak to off-peak periods.⁷⁹ Based on these workshops and input from parties, Energy Division will issue a Staff Proposal via Ruling on how best to incorporate HPWHs into SGIP, potentially including, modifications on how cost-effectiveness is calculated.

DER Cost-Effectiveness

⁷⁵ D.11-09-015, p.18

⁷⁶ See: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M310/K260/310260347.PDF>.

⁷⁷ See: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M313/K975/313975481.PDF>.

⁷⁸ See: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M325/K979/325979689.PDF>.

⁷⁹ Workshop slides are available at: <https://www.cpuc.ca.gov/sgip/>.

The CPUC is also working in the Integrated Distributed Energy Resources (IDER) proceeding (R.14-10-003) to adopt an overarching policy framework for DERs, outlined in D.15-09-022 as:

“A regulatory framework, developed by the Commission to enable utility customers to most effectively and efficiently choose from an array of distributed energy resources (DERs)⁸⁰ taking into consideration the impact and interaction of such resources on the grid as a whole, individual customer’s energy usage, and the environment.”⁸¹

To accomplish this vision, the CPUC adopted D.19-05-019, establishing the TRC as the “primary test of cost-effectiveness for all distributed energy resources (DERs) applicable filings or advice letters submittals that require cost-effectiveness analyses, beginning on July 1, 2019, and thereafter.”⁸² It also required that the “modified TRC, PAC, and RIM tests” be used in all cost-effectiveness analyses beginning of July 1, 2019.⁸³ Previously, D.16-06-007 in the IDER proceeding required all DERs to use the latest version of the ACC for all DER cost-effectiveness analysis, and required the ACC to be update annually.

WatterSaver Program Cost-Effectiveness

With a baseline understanding of cost-effectiveness, and how it has been applied to other thermal energy storage programs, we return to Cal Advocates claim that

⁸⁰ DERs are categorized in the IDER proceeding in alignment with PU Code Section 739 which defines distributed resources as renewable generation, energy efficiency, energy storage, electric vehicles, and demand response technologies. See:

https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=739.&lawCode=PUC.

⁸¹ D.15-09-022, p.18. See:

<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M154/K464/154464227.PDF>.

⁸² D.19-05-019, p.2. See:

<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M293/K833/293833387.PDF>.

⁸³ *ibid*.

the program is not cost-effective. In their July 10, 2020 protest Cal Advocates' requests that the Commission reject PG&E's AL because the included ratepayer benefits are less than approved ratepayer funded costs. Cal Advocates' claim has merit, but we also cannot make a determination based on the information provided.

Unlike for other thermal energy storage programs, D.19-06-032 did not determine which cost-effectiveness tests are required or determine if, and how, the tests should be used to approve or deny AB 2868 programs. The Decision does state that "the Commission agrees that the investor owned utilities must demonstrate cost-effectiveness for the resulting procurement from AB 2868 to be reasonable, and thus recovered in rates" and requires future applications to be filed with a cost-effectiveness showing that "includes the net present value, net market value, and least cost, best fit cost calculations."⁸⁴ Traditionally, this approach to cost-effectiveness is used to evaluate the procurement of utility owned energy storage, and not administration of utility programs. Regardless, of applicability of the adopted cost-effectiveness evaluation PG&E's AB 2868 application did not include any. Instead, the program was approved because PG&E's proposal provided "unique value to customers that want to engage with behind the meter storage, within the guidance of AB 2868. In response to Energy Division staff's request for a cost-effectiveness showing, PG&E developed a cost-effectiveness calculation that has, "similarities to the existing analyses in the California Standard Practice Manual but is currently a trial evaluation methodology developed for the WatterSaver Program." Unfortunately, PG&E's cost-effectiveness showing is not in alignment with D.19-05-019 which requires, as of July 1, 2019, that all DER cost-effectiveness analysis include the TRC, PAC, and RIM tests.

We also find that there are additional program benefits that should be valued to achieve the legislative intent of AB 2868 to approve investments and programs that lead to:

⁸⁴ D.19-06-032, p.56. See:

<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M309/K522/309522481.PDF>.

- The accelerated deployment of distributed energy storage systems to achieve ratepayer benefits;
- The reduction of dependence on petroleum;
- The obtainment of air quality standards in areas of non-obtainment or poor air quality; and
- The reduction of GHG emissions.

For example, we find it appropriate for PG&E to qualitatively value the accelerated deployment of distributed energy storage systems, similar to how market transformation benefits are valued in other programs such as SGIP. We also find it appropriate for PG&E to quantitatively value the criteria air pollutant reductions achieved by the WatterSaver program. And we believe it is important to understand the benefits participant would receive from participating in the program. These benefit values and perspectives are currently absent from PG&E's analysis. Instead of evaluating the program solely based on analysis provided by PG&E we correct the record here by detailing how cost-effectiveness for an AB 2868 BTM program such as WatterSaver, should be calculated.

To start, we determine that the WatterSaver program, like all other DER programs, is required to complete a cost-effectiveness analysis that includes the TRC, PAC, and RIM tests. This determination brings the program into alignment with D.19-05-019. We also find it appropriate to align the WatterSaver program with cost-effectiveness test requirements of both the PLS programs and SGIP, since it is a thermal energy storage program. These programs, in addition to the TRC, PAC and RIM tests also calculate the Participant Cost test (PCT), to understand the benefits a participant would receive, and a version of the societal test, to capture program externalities such as air pollution. We find the SCT as adopted in D.19-05-019 is the most appropriate version of the societal test for the program to use. The SCT values the societal cost of carbon, captures improvements to air quality, via an air quality adder, and uses a societal discount rate to value the program's avoided costs. Compared to the TRC, the SCT more accurately values the program's societal goals, including the reduction of petroleum, the reduction of greenhouse gas emissions, and meeting air quality standards. The use of SCT here will also inform the record on the appropriate use

of the test in evaluating future DER programs. Together, these five tests will allow the CPUC to holistically assess the program's impact from a variety of perspectives.

Next, we find it necessary to clarify how the program benefits and programs costs for each of these tests should be calculated for each sub-program. Starting with the ERWH and HPWH sub-programs, we find PG&E's proposed methodology to calculate the program benefits to be inaccurate. As proposed, PG&E calculates the program benefits for its ERWH and HPWH sub-programs as the net ACC benefits achieved by program's control system, when comparing an uncontrolled load curve, against a controlled, or load-shifting, load curve. This net benefit calculation of benefits plus "negative benefits", in effect hides the electricity system supply costs increases associated with using either an ERWH or a HPWH as thermal energy storage.

For example, PG&E estimates that during the hour from 12:00 PM to 1:00 PM electricity will increase by 0.19 kWh as the HPWH is being signaled to use additional electricity to generate additional hot water for use later.⁸⁵ This increase in electricity is a supply cost increase to the utility and should be accounted for as a program cost, not a "negative benefit". In comparison, PG&E estimates that during the hour from 8:00 PM to 9:00 PM electricity use will decrease by 0.28 kWh as the HPWH has enough hot water to meet demand.⁸⁶ This decrease in electricity is a supply cost avoided to the utility and should be accounted for as a program benefit.

We also find PG&E's proposed methodology to calculate the program benefits for its PWH sub-program to be inaccurate. As proposed, PG&E calculates the program benefits for its PWH sub-program as the net value of the negative ACC benefits associated with the electrification of the PWH and the ACC benefits achieved by the program's control system when comparing an uncontrolled

⁸⁵ PG&E's Cal Advocates Data Request 003-Q04 January 17, 2020, p.2.

⁸⁶ PG&E's Cal Advocates Data Request 003-Q04, January 17, 2020 p.2.

HPWH load curve, against a HPWH controlled, or load-shifting, load curve. We find this program benefit calculation incorrect in two ways. First, the increase of electricity associated with the electrification of a PWH is a supply cost increase to the utility and should be accounted for as a program cost. Second, like the ERWH and HPWH sub-programs the electricity increases, and decreases achieved by using the new HPWH as thermal energy storage should be accounted for separately as program costs and program benefits.

Next, we clarify how the air pollution improvements achieved by the program should be calculated. In D.19-05-019, of the IDER proceeding, the CPUC adopted an interim air quality adder value of \$6.00 per MWh that “measures the impact of air pollution for electric power plants on human health.”⁸⁷ Given that air quality improvement is stated goal of AB 2868, we find it appropriate for PG&E to use this interim value, or a subsequent value, if one is adopted by the Commission in the future, to quantify the air quality benefits provided by the WatterSaver program. Using the currently adopted air quality value and PG&E’s proposed 6.76 MWh per day program load-shift, we can estimate an annual air quality program benefit of \$14,804.40, and five-year program benefit of \$74,022.⁸⁸

Finally, we clarify that the WatterSaver program is required to use the 2020 ACC, or the most recently adopted ACC, to calculate the program’s avoided costs. As noted earlier, in D.16-06-007, the Commission ordered “all distributed energy resource proceedings to use the avoided cost calculator adopted,” and to do so “when a cost-effectiveness analysis is required.”⁸⁹

With the program benefits and program costs calculations clarified we next summarize how they should be accounted for in each of the different cost-effectiveness tests. Table 6 summarizes this information for the ERWH and

⁸⁷ D.19-05-019, p.12.

⁸⁸ Annual air quality benefit calculation: $(6.76 \text{ MWh/day})(\$6.00 \text{ per MWh})(365) = \$14,804.40$. Five-year air quality benefit calculation: $(6.76 \text{ MWh/day})(\$6.00 \text{ per MWh})(365)(5) = \$74,022$.

⁸⁹ D.16-06-007, p.5.

HPWH sub-programs and Table 7 summarizes this information for the PWH sub-program.

	TRC	PAC	RIM	Participant	SCT
Administrative Costs	COST	COST	COST	N/A	COST
Air Quality Improvements	N/A	N/A	N/A	N/A	BENEFIT
Avoided costs of electricity	BENEFIT	BENEFIT	BENEFIT	N/A	BENEFIT
Bill Reductions/Revenue Losses	N/A	N/A	COST	BENEFIT	N/A
Direct Implementation Non-Incentive Costs	COST	COST	COST	N/A	COST
Increased costs of electricity	COST	COST	COST	N/A	COST
Incentive Costs	N/A	COST	COST	BENEFIT	N/A
Marketing Costs	COST	COST	COST	N/A	COST
Participant Costs	COST	COST	COST	COST	

Table 6: Program benefits and program costs for the WatterSaver's ERWH and HPWH sub-programs.

	TRC	PAC	RIM	Participant	SCT
Administrative Costs	COST	COST	COST	N/A	COST
Air Quality Improvements	N/A	N/A	N/A	N/A	BENEFIT
Avoided costs of electricity	BENEFIT	BENEFIT	BENEFIT	N/A	BENFIT
Direct Implementation Non-Incentive Costs	COST	COST	COST	N/A	COST

Increased costs of electricity	COST	COST	COST	N/A	COST
Incentive Costs	N/A	COST	COST	BENEFIT	N/A
Marketing Costs	COST	COST	COST	N/A	COST
Participant Costs	COST	COST	COST	COST	COST
Reduced Propane Use	BENEFIT	N/A	COST	BENEFIT	BENEFIT

Table 7: Program benefits and program costs for the WatterSaver's PWH sub-program.

Finally, we determine whether it is appropriate to use a cost-effectiveness threshold of 1.0 to approve this program. As adopted in PU Code Section 2835, all energy storage shall be cost-effective. In D.19-06-032, we affirmed that PU Code Section 2835 applies to AB 2868 programs and required programs adhere to a cost-effectiveness requirement. However, D.19-06-032 did not specify which cost-effectiveness test must be used to meet this requirement or determine if, or when, it may be appropriate to approve a program with a cost-effectiveness ratio less than 1.0. To determine this, we review the precedent established in the PLS program and SGIP.

In the context of the PLS program, cost-effectiveness evolved from not being applied to the program pilots from 2007 to 2011 to being in alignment with all other DR programs, as established in D.17-12-003. As adopted, D.17-12-013 requires all DR programs, including the PLS program, to achieve “a TRC cost-effectiveness ratio of 1.0 for each program” or provide the Commission with “continuous progress reporting on the program with qualitative and quantitative indicators in lieu of a 1.0 TRC ratio.”⁹⁰ We find this Decision’s guidance insightful but limiting because only “mature” load-shifting technologies were eligible for the PLS programs. The application of different smart control and communication technologies that enable both HPWHs and ERWHs to act as thermal energy storage have shown promise in model studies⁹¹ and in small field

⁹⁰ D.17-12-013, p.121.

⁹¹ Ecotope’s 2018 Heat Pump Water Heater Electric Load Shifting: A Modeling Study, successfully demonstrated a range savings potential of HPWH load shifting for both the utility and the customer

demonstrations,⁹² but should not be considered a “mature” technology that would qualify for the PLS program. In addition, PG&E did not calculate the TRC test for the WatterSaver program to be compared against.

In the context of SGIP, D.11-09-015 determined that it is inappropriate to use a cost-effectiveness screening due to the hampering effect it would have on market transformation and to focus on qualifying technologies that can achieve GHG reductions, amongst other reasons. For this reason, many of the eligible SGIP technologies have been classified as “emerging” technologies, including HPWHs. If the WatterSaver program was to fully align with the SGIP framework, the smart controls and communication technologies of the WatterSaver program would be required to meet all the statutory goals of the program, including, GHG emission reduction requirements. This may be possible to prove from a technical perspective, but the CPUC has not adopted a policy on the inclusion of smart controls and communication technologies in the SGIP.

While we believe that AB 2868’s legislative intent is to encourage the “widespread deployment” of distributed energy systems in a market development or market transformation fashion, we find it inappropriate to align the WatterSaver program with the cost-effectiveness requirements of SGIP, which are legislatively driven. Instead we find it appropriate to align the WatterSaver program cost-effectiveness requirements with DR programs and the requirements of D.17-12-013. This approach further aligns the program with D.19-05-019 of the IDER proceeding requiring that the TRC be used as the main cost-effectiveness test. In addition, it also allows the Commission when reviewing a compelling Application, to approve program designs below the 1.0

using a variety of control methods. See: https://ecotope-publications-database.ecotope.com/2018_001_HPWHLoadShiftingModelingStudy.pdf.

⁹² Bonneville Power Authority’s CTA-2045 Water Heater Demonstration Report Including A Business Case for CTA-2045 Market Transformation, successfully demonstrated that smart connected water heaters, both ERWH and HPWH, can yield cost savings compared to building peaking plants. See: <https://www.bpa.gov/EE/Technology/demand-response/Documents/Demand%20Response%20-%20FINAL%20REPORT%20110918.pdf>.

TRC threshold, but require continuous progress reporting as they seek to achieve cost-effectiveness. This balance between strict cost-effectiveness and continuous improvement is in alignment with AB 2868's intent to approve programs that achieve multiple goals, including programs that accelerate market deployment of distributed energy systems.

Given this determination and in lieu of TRC test being calculated we find it appropriate to provide final approval with modification to the WatterSaver program. PG&E is required to provide Energy Division with annual progress reports via AL as ordered in this Resolution.

WatterSaver's Widespread Deployment of DES

Next, we turn to Cal Advocates' claim that the WatterSaver program does not promote widespread deployment of DES to achieve ratepayer benefits. We find Cal Advocates' claim inaccurate. As noted earlier the application of different smart control and communication technologies that enable both ERWHs and HPWHs to act as thermal energy storage have shown promise in model studies⁹³ and in small field demonstrations.⁹⁴ In D.18-12-015, of the San Joaquin Valley Affordable Energy proceeding, we acknowledged this promise in a small way by directing PG&E and SCE to target a 150 HPWHs with "local preset controls and/or digital communications technologies."⁹⁵ We believe the WatterSaver

⁹³ Ecotope's 2018 Heat Pump Water Heater Electric Load Shifting: A Modeling Study, successfully demonstrated a range savings potential of HPWH load shifting for both the utility and the customer using a variety of control methods. See: https://ecotope-publications-database.ecotope.com/2018_001_HPWHLoadShiftingModelingStudy.pdf.

⁹⁴ Bonneville Power Authority's CTA-2045 Water Heater Demonstration Report Including A Business Case for CTA-2045 Market Transformation, successfully demonstrated that smart connected water heaters, both ERWH and HPWH, can yield cost savings compared to building peaking plants. See: <https://www.bpa.gov/EE/Technology/demand-response/Documents/Demand%20Response%20-%20FINANCIAL%20REPORT%20110918.pdf>.

⁹⁵ D.18-12-015, p.121. See: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M252/K522/252522682.PDF>.

program builds upon this first step and further promotes the widespread deployment of ERWHs and HPWHs as thermal DES, by providing incentives for the required smart controls and communication technologies. In the absence of the WatterSaver program there is no other program adopted by the CPUC that achieves this goal.

Cal Advocate's Proposed Program Modifications

Finally, we consider the two program modifications proposed by Cal Advocates in their July 10, 2020 protest.

The first modification proposed is the elimination of the proposed centralized control management system in favor of a decentralized control management approach. Cal Advocates claims that a decentralized control approach could provide all the benefits of the centralized system and save \$2,100,000 over the course of the five-year program. Before considering the proposed modification, we must clarify that the centralized energy management system does not cost \$2,100,000. The entire direct implementation non-incentives budget, as filed in PG&E's supplemental AL, is \$2,124,956. This budget category includes the following costs:

- Overall program design and implementation customer enrollment and support;
- Coordination with the non-WatterSaver HPWH installation and rebate programs; and
- Load-shifting software management, analysis, and technical services.

PG&E did not provide a more detailed cost breakdown of this budget category, so claiming this entire budget is for the centralized management system is conjecture.

With the budget clarified, we now respond to Cal Advocates' proposal to shift from a centralized to a decentralized control approach. As proposed by PG&E, the central energy management system will "communicate with smart devices multiple times per minute, receiving data back on key variables including,

appliance mode, tank temperature, and setpoint.”⁹⁶ The decentralized approach proposed by Cal Advocates is not clearly defined, but rather is based on PG&E’s statement that, “the smart control devices installed or enabled through the WatterSaver program have the ability to provide ACC [or load-shifting] benefits through their expected useful life of 10 years.”⁹⁷ While we appreciate PG&E’s and Cal Advocates’ belief that a decentralized approach could provide program benefits beyond the five-year program period, there is not sufficient record to support this claim.

In neither PG&E’s Supplemental Advice Letter nor Cal Advocates’ protests was there technical exploration of how a decentralized approach would be implemented, measured, or verified, either during or after program implementation. We find the concept interesting, but given the lack of record, we cannot adopt the modification.

In addition to a lack of record on the topic, the adoption of a decentralized control approach would eliminate the ability to gather valuable data via the centralized management system. We find this level of data to be to essential for both short-term program success and long-term deployment of ERWHs and HPWHs as thermal DES. This data would enable PG&E to verify and maximize the WatterSaver program benefits, and help interested parties verify the success and attribution of the program. In addition, we find it appropriate for PG&E to establish, monitor and verify the ability of a decentralized control subgroup to provide similar benefits to ERWHs and HPWHs being managed by a centralized system. This data helps inform Energy Division staff as they design and provide recommendations for other ERWH and HPWH thermal energy storage programs Without this centralized system, none of these benefits will be captured.

Finally, the elimination of the central system goes against the direction we provided in D.18-12-015. In addition to that decision ordering PG&E and SCE to

⁹⁶ PG&E AL 5731-E, p.7.

⁹⁷ AL 5731-E-A, p.8.

target the installation of 150 control enabled HPWHs, the decision also directed PG&E to fund the dispatch architecture to control the devices in its “AB 2868 Energy Storage Investment/Program Proposals.”⁹⁸ Given our clear and prior direction that this program should fund a centralized energy management systems with the capability to dispatch participating HPWHs we find it inappropriate to eliminate the system.

Elimination of the HPWH Sub-Program

The second modification proposed by Cal Advocates is the elimination of the HPWH sub-program and re-allocation of those funds to the ERWH sub-program to improve overall program cost-effectiveness. As currently proposed, the WatterSaver program achieves its 2.5 MW peak-demand reduction target by enabling 6,467 HPWHs (6,400 residential and 67 commercial units) and 1,400 ERWHs (1,112 residential and 28 commercial units). This results in a technology enrollment ratio of 85/15 weighted toward HPWHs. The elimination the HPWH sub-program - and, we assume, the elimination of the PWH sub-program, as those units would be replaced with HPWHs – would allow the WatterSaver program to only target approximately 4,900 ERWH units⁹⁹ at a lower overall program cost. While we appreciate Cal Advocates’ desire to maximize the ratepayer benefits of the WatterSaver program, eliminating the HPWH sub-program sends the wrong market signal and conflicts with AB 2868’s goals of accelerating the widespread deployment of DES and reducing petroleum usage.

Our first concern is that, by eliminating the HPWH sub-program entirely, we are sending the California water heating marketplace a signal of long-term support for the installation of new ERWHs. Newly installed ERWHs have long been recognized by the CPUC as an inefficient method for providing water heating. The CPUC acknowledged this concern in D.18-12-015 by rejecting SCE’s proposal

⁹⁸ D.18-12-015, p.121.

⁹⁹ This 4,900-unit estimate is calculated by dividing the program MW goal of 2.5 MWs, by the estimated load-shift potential of each residential ERWH unit, or 0.51 kw.

to include new ERWHs in the San Joaquin Valley pilot programs. At the same time, we also acknowledge that for existing ERWHs the installation of smart controls and communication technologies can provide the enrolled customer with utility bill savings and PG&E with multiple benefits. For this reason, we find it appropriate to enable existing ERWH to serve as thermal energy storage and reiterate that the CPUC does not support the installation of new ERWHs, unless extenuating circumstances make it unfeasible to replace with a HPWH.

Our second concern is that, by eliminating the HPWH sub-program – and, as a secondary effect, the PWH sub-program – we would conflict with AB 2868’s goals of accelerating the widespread deployment of DES and reduction of petroleum usage. The installation of HPWHs and enablement of those devices as thermal energy storage in California will dramatically increase in the coming decade as the state strives to further encourage building decarbonization. Encouraging the adoption of HPWHs and fully utilizing their ability to shift load will require long-term financial support and a technical understanding of how best to enable and operate the technology as thermal energy storage. By eliminating the HPWH sub-program, we would be eliminating the WatterSaver program’s ability to contribute to that technical understanding and retarding, not accelerating, its widespread deployment. Secondarily, the downstream effect of the PWH sub-program being eliminated conflicts with AB 2868’s goal of reduced petroleum usage.

For these reasons, we reject Cal Advocates’s proposal to eliminate the HPWH sub-program and instead direct PG&E to modify its technology enrollment ratio to both improve cost-effectiveness and maximize ratepayer benefits, as detailed below.

WatterSaver Program Determination

Throughout this Resolution, we have reviewed the information presented and protested in Advice Letter. We have further provided background on cost-effectiveness frameworks for other thermal energy storage programs and explained why we rejected Cal Advocates’ proposed program modifications. We now approve PG&E’s WatterSaver program with the following modifications.

First, we approve the program with the requirement that PG&E provide continuous progress reporting on the program, with qualitative and quantitative indicators in lieu of achieving cost-effectiveness. Reporting shall be completed annually by December 31 starting in 2021 through a Tier 1 Advice Letter, unless otherwise directed. The Advice Letter shall include all the Data & Reporting Key Performance Indicators (KPIs) identified in AL 5731-E, and the cost-effectiveness tests as ordered here.

Second, we direct PG&E to calculate the Total Resource Cost test, the Program Administrator Cost test, the Ratepayer Impact Measure test, the Participant Cost Test, and the Societal Cost Test in each Advice Letter filing as defined in this Resolution. These tests can be calculated using the CPUC's Cost-Effectiveness Tool, or via Excel spreadsheet.

Third, we direct PG&E to maintain the program's goal of 2.5 MW peak reduction but modify the WatterSaver program's targeted technology enrollment ratio of HPWHs and ERWHs from an 85/15 ratio to a 60/40 ratio. This ratio adjustment is an effort to improve the program's cost-effectiveness and ensure that ratepayer benefits are being maximized. This program ratio shall be considered set for the life of the program and shall not be adjusted further. The new 60/40 technology ratio shall also be used in required the cost-effectiveness analysis.

Fourth, we direct PG&E to file a Tier 2 Advice Letter to Energy Division by December 31, 2021 proposing how the WatterSaver program budget, program incentives, program control strategies, and program elements, such as qualifying rates, could be modified to further improve cost-effectiveness in relation to other CPUC programs. As was noted by Cal Advocates, there are numerous other ratepayer-funded programs that promote the adoption of HPWHs, including the SGIP, ESA, and the TECH Initiative. However, many of these approved programs have yet to adopt formal implementation plans with specific implementation details. In addition, PG&E in A.19-11-019 recently filed a new

“E-Elec” rate design that may improve the bill saving benefits for customers.¹⁰⁰ Instead of rejecting the WatterSaver program due to new policy developments, we direct PG&E to adapt the WatterSaver program, which was approved prior to these other programs, in such a manner that would improve cost-effectiveness. This Tier 2 Advice Letter shall not modify any cost-effectiveness guidance established in this Resolution or eliminate the annual reporting requirements for years 2022, 2023, 2024, or 2025.

COMMENTS

Public Utilities Code section 311(g)(1) provides that this Resolution must be served on all parties and subject to at least 30 days public review. Please note - that comments are due 20 days from the mailing date of this Resolution. Section 311(g)(2) provides that this 30-day review period and 20-day comment period may be reduced or waived upon the stipulation of all parties in the proceeding.

The 30-day review and 20-day comment period for the draft of this Resolution was neither waived nor reduced. Accordingly, this draft Resolution was mailed to parties for comments, and will be placed on the Commission’s agenda no earlier than 30 days from today.

FINDINGS

1. Assembly Bill (AB) 2868 (Gatto, 2016) directed the California Public Utility Commission (CPUC) to direct the state’s three large electrical corporations to file applications for programs and investments to accelerate the widespread adoption of distributed energy storage systems.
2. On June 27, 2019, the CPUC adopted D.19-06-32 implementing the AB 2868 energy storage program and investment framework and approving AB 2868 applications with modifications.

¹⁰⁰ See: <https://pgera.azurewebsites.net/Regulation/ValidateDocAccess?docID=605900Testimony>.

3. D.19-06-32 denied PG&E's request for approval for its 166.66 MW procurement for distribution-connected energy storage and approved up to \$6,400,000 in funding for its BTM thermal energy storage program.
4. D.19-06-032 ordered PG&E to proceed with its BTM thermal energy storage during the period from 2019 to 2025, subject to filing a subsequent Tier 3 Advice Letter for final approval.
5. On December 31, 2019, PG&E filed Advice Letter (AL) 5731-E. The AL included six categories of program implementation details and proposed to call the program WatterSaver.
6. On January 21, 2020, the Public Advocates Office at the California Public Utilities Commission (Cal Advocates) filed a protest to PG&E's AL 5731-E requesting the CPUC require PG&E to demonstrate program cost-effectiveness and provide additional program details.
7. On January 21, 2020, the Small Business Utility Advocates (SUBA) filed a protest to PG&E's AL-5731 requesting the CPUC require PG&E to implement improvements to the small business component of the WatterSaver program and provide additional program details to determine if the program is useful and cost-effective.
8. On June 19, 2020, PG&E filed supplemental AL-5731-E-A in response to the Energy Division's supplement AL request for additional program details.
9. Based on the E-TOU-C rate design PG&E estimated that a program participant enrolled with a HPWH could have no increase or decrease in bill savings in the absence of other changes.
10. Based on the E-TOU-C rate design PG&E estimated that a program participant enrolled with an electric resistance water heater (ERWH) could have their bill decrease by \$20 per year.
11. PG&E proposed a program budget that included categories for administrative, marketing, direction implementation non-incentives, and incentives costs.
12. PG&E completed a cost-effectiveness analysis of the WatterSaver program at a sub-program level, and at a total program level using two different program benefit scenarios.
13. PG&E completed a cost-effectiveness analysis for each scenario, each sub-program, and the total program taking into consideration the program costs, the participant costs, the program benefits, and the participants benefits.

14. PG&E proposed the program benefits for the ERWH and HPWH sub-programs are the electricity system avoided costs achieved through load-shifting.
15. PG&E proposed the program benefits for the PWH program are the ACC negative benefits associated with increased electricity usage as a result of the newly installed HPWH and the ACC positive benefits achieved through load-shifting the HPWH.
16. PG&E used the 2019 ACC values to calculate program benefits for each sub-program and the total program.
17. On July 10, 2020, Cal Advocates filed a protest to PG&E's supplemental AL 5731-E-A requesting the CPUC reject the AL due the program's minimal bill savings and the program not being cost-effective or use the authority provided under PU Code Section 2828.2(c)(1) to modify the program to ensure compliance with AB 2868 and D.19-06-032.
18. PG&E's initial Advice Letter 5731-E lacked the substantive program details necessary for Energy Division to make a determination on the program.
19. D.19-06-032 did not require a specific carve out budget for small businesses, and the inclusion of 100 small business HPWHs and ERWHs is reasonable.
20. PG&E's HPWH sub-program is the only sub-program is the only sub-program that may not achieve any bill savings.
21. PG&E's ERWH sub-program is estimated to provide annual bill savings of \$20 for residential customers and \$60 for commercial customers.
22. The WatterSaver bill savings estimates are based PG&E's E-TOU-C rate, which has small pricing differential between its peak and off-peak periods.
23. During the summer months from June to September, PG&E's E-TOU-C rate has a peak to off-peak pricing differential, not taking into consideration any baseline credit, is \$0.063.
24. During the winter months from October to May, PG&E's E-TOU-C has a peak to off-peak pricing differential, not taking into consideration any baseline credit, is \$0.018.
25. The PLS cost-effectiveness framework included the requirement that the: TRC, PAC, RIM, and PCT test be calculated.
26. D.17-12-003 adopted the requirement that all DR programs achieve a TRC ratio of 1.0 or lieu of a TRC 1.0 of provide the CPUC with a continuous

progress reports on the program that include qualitative and quantitative indicators.

27. D.09-08-026 implemented a cost-effectiveness framework for SGIP and other distributed generation (DG) technology programs, and ordered DG programs to calculate the PCT, the TRC, and PAC tests for program evaluation.
28. D.09-08-026 directed DG programs to quantify the market transformation effects of the program.
29. D.19-05-019 required the TRC, PAC, and RIM tests be used in all cost-effectiveness analyses effective July 1, 2019.
30. D.19-06-032 did not adopt a clear cost-effectiveness framework for BTM AB 2868 programs.
31. The AB 2868 legislation identified four goals upon which investments and programs should be approved upon, including accelerated deployment of distributed energy storage systems to achieve ratepayer benefits, reduction of dependence on petroleum, obtainment of air quality standards in areas of non-obtainment or poor air quality, and reduction of GHG emissions.
32. It is reasonable to qualitatively value the accelerated deployment of distributed energy storage systems, similar to how market transformation benefits are valued in other programs like SGIP.
33. It is reasonable to quantitatively value the criteria air pollutant reductions achieved by the WatterSaver program.
34. It is reasonable for the WatterSaver program to be required to calculate the TRC, PAC, and RIM tests in alignment with D.19-06-032.
35. It is reasonable for a thermal energy storage program like the WatterSaver program to also calculate the PCT and a societal test in alignment with the PLS program and the SGIP.
36. It is reasonable for PG&E to calculate the SCT as adopted in D.19-05-019.
37. It is reasonable to account for the increased electricity consumption associated with load-shifting a HPWH or ERWH as an increased supply cost to the utility, and thus a program cost.
38. It is reasonable to account for the decreased electricity consumption associated with load-shifting a HPWH or ERWH as a decreased supply cost to the utility, and thus a program benefit.

39. It is reasonable to account for the increased electricity consumption associated with the electrification of propane water heater as an increased supply cost to the utility, and thus a program cost.
40. It is reasonable to use the interim air quality adder, or latest value adopted by the Commission, to quantify the air quality benefits provided by the WatterSaver program.
41. It is reasonable for PG&E to use the 2020 ACC, or most recently adopted ACC, to calculate the program's avoided costs.
42. D.19-06-032 did not specify which cost-effectiveness test must be used to meet the cost-effectiveness requirement of PU Code Section 2835.
43. D.19-06-032 did not determine if, or when, it may be appropriate to approve a program with a cost-effectiveness ratio less than 1.0.
44. It is reasonable to determine which cost-effectiveness test should be used to meet the requirement of PU Code Section and if, or when, it may be appropriate to approve a program with a cost-effectiveness ratio less than 1.0 based on precedent established for the PLS programs and the SGIP.
45. It is reasonable to align the WatterSaver program's cost-effectiveness requirements with those adopted in D.17-12-013.
46. It is reasonable to approve the WatterSaver program with the requirement that PG&E provide Energy Division with annual progress reports via advice letter.
47. PG&E proposed its direct implementation non-incentives budget at \$2,124,956.
48. PG&E's proposed direct implementation non-incentives budget includes the costs for (1) the overall program design and implementation customer enrollment support; (2) the coordination with non-WatterSaver HPWH installation and rebate programs; and (3) load-shifting software management, analysis, and technical services.
49. In the absence of a detailed budget breakdown, it is reasonable to assume the centralized management system does not cost \$2,100,000.
50. Neither PG&E nor Cal Advocates provided a technical explanation of how a decentralized approach would be implemented, measured, or verified, either during or after program implementation.
51. Due to the lack of record, it is not reasonable to eliminate the central energy management system and adopt a decentralized system approach.

52. D.18-12-015 directed PG&E to fund a centralized dispatch architecture with the ability to control the 150 controlled enabled HPWHs installed as part of the San Joaquin Valley Clean Energy Pilot.
53. It is reasonable to determine that the elimination of the centralized system in the WatterSaver program is in contradiction with the direction provided by D.18-12-015.
54. PG&E proposed the WatterSaver program can achieve a 2.5 megawatt (MW) peak-demand reduction by installing smart controls and communication technologies on 6,467 HPWHs, 6,400 residential and 67 commercial units, and 1,400 ERWHs, 1,112 residential and 28 commercial units.
55. It is reasonable to determine that as proposed by PG&E the WatterSaver's program technology ratio is 85/15 weighted towards HPWHs.
56. It is reasonable to adjust the WatterSaver's program technology ratio to 60/40 weighted towards HPWHs.
57. It is reasonable to determine the elimination of the HPWH sub-program retards the widespread deployment of HPWHs as thermal energy storage.
58. It is reasonable to determine that eliminating the PWH sub-program conflicts with AB 2868's goal to reduce petroleum usage.

THEREFORE IT IS ORDERED THAT:

1. Pacific Gas and Electric Company's Tier 3 Advice Letter 5731-E and supplemental Advice Letter 5731-E-A are approved with the modifications set forth below and otherwise specified herein.
2. In lieu of the program achieving cost-effectiveness, Pacific Gas and Electric Company shall file annual program reports via advice letter that, at a minimum, shall include all the key performance indicators identified in Advice Letter 5731-E and cost-effectiveness showing as defined here.
3. Pacific Gas and Electric Company shall calculate the Total Resource Cost test, the Program Administrator Cost test, the Ratepayer Impact Measure test, the Participant Cost Test, and the Societal Cost Test in each Advice Letter filing as defined in this Resolution.
4. Pacific Gas and Electric Company shall calculate these cost-effectiveness test using the latest cost-effectiveness tool version, or when necessary, an Excel spreadsheet file.
5. Pacific Gas and Electric Company shall maintain the program goal of reducing 2.5 MWs of peak load.

6. Pacific Gas and Electric Company shall modify the program's targeted technology enrollment ratio of heat pump water heaters and electric resistance water heaters from an 85/15 ratio to a 60/40 ratio.
7. Pacific Gas and Electric Company shall not modify the program's targeted technology enrollment ratio during the approved five-year program period.
8. Pacific Gas and Electric Company shall submit no later than December 31, 2021, a Tier 2 Advice Letter to Energy Division, including its annual program report and proposals for how the WatterSaver's program budget, program incentives, program control strategies, program required rate, and other program elements could be modified to improve program cost-effectiveness in relation to other related programs adopted.
9. Pacific Gas and Electric Company in its December 31, 2021 Tier 2 Advice Letter filing shall include details on how to establish, monitor and verify the ability of a decentralized control subgroup to provide similar benefits to ERWHs and HPWHs being managed by a centralized system.
10. No later than December 31 of each subsequent year through 2025, Pacific Gas and Electric company shall file its annual program report via Tier 1 Advice Letter to Energy Division.

This Resolution is effective today.

I certify that the foregoing Resolution was duly introduced, passed and adopted at a conference of the Public Utilities Commission of the State of California held on December 3, 2020, the following Commissioners voting favorably thereon:

Rachel Peterson
Acting Executive Director