



California Public Utilities Commission
505 Van Ness Ave., San Francisco

MEMORANDUM

Date: April 28, 2025

To: Biermayer, Peter Peter.Biermayer@cpuc.ca.gov; Hoadley, Leanne Leanne.Hoadley@cpuc.ca.gov; Reardon, Amy amy.reardon@cpuc.ca.gov; Torok, Christina Christina.Torok@cpuc.ca.gov; William, Graswich William.Graswich@cpuc.ca.gov; Taffel, Jonathan Jonathan.taffel@cpuc.ca.gov; Shahinfard, Sepideh sepidehs@quantum-ea.com; Bradley, Kris krisb@quantum-ea.com; Marion, Powanda, Ryan ryan.powanda@guidedhouse.com; Liu, Henry hfl3@pge.com; Hla, Soe SKHJ@pge.com; Voong, Tai TXV0@pge.com; Rosillo, Adan A6RZ@pge.com; BRK8@pge.com; Ng, Danny d1n1@pge.com; Cho, Ryan Ryan.Cho@sce.com; Rauss, Cassie cassie.rauss@sce.com; Diddi, Vishal vishal.diddi@sce.com; Tsan, Bach bach.tsan@sce.com; Ritchey, David david.ritchey@sce.com; Zwick, John R JZwick@sdge.com; Reynoso, Ed EReynoso@sdge.com; Gibson, James JGibson2@sdge.com; Liljestrom, Kenny W KLiljest@sdge.com; Houdyshel, Rod H RHoudyshel@sdge.com; Rodriguez, Ada L ARodri24@sdge.com; Valenzuela, Keith KValenz1@sdgecontractor.com; Kettool, Christopher R CKettool@sdge.com; Bracamonte, Briana K BBracamo@sdge.com; Thomas, Reggie E RThomas4@sdge.com; Sybert, Tyler N TSybert@sdge.com; Nauta, Yvonne S. YNauta@sdge.com; Abraham, Taghreed TAbraham@sdge.com; Shumake, Zachary ZShumake@sdge.com; Rincon, Ernie ERincon@sdge.com; Hernandez, Jon C JHerna20@sdge.com; Fitch, Andrea AFitch2@sdge.com; Watts, Leah N LWatts1@sdge.com; Valenzuela, Kelvin KValenzuela@sdge.com; Danryd, Anders ADanryd@socalgas.com; Marquez, Andres AMarquez3@socalgas.com; Choi, James MChoi1@socalgas.com; Walters, Michael MWalters@socalgas.com; Mowery, Kimberly D KMowery@socalgas.com; Garcia, Martha marthagarcia@socalgas.com; Oyan, Bryan P BOyan@socalgas.com; Lipp, Spencer Spencer.Lipp@FutEE.biz; Daukoru, Michael Michael.Daukoru@FutEE.biz; Nguyen, Chau chau.nguyen@futee.biz; Craig, Fernanda fcraig@isd.lacounty.gov; Medina, Lujana Imedina@isd.lacounty.gov; Broten, Scott Scott.Broten@icf.com; Long, Steven Steven.Long@icf.com; Gutierrez, Alfredo Alfredo.Gutierrez@icf.com; Leigh, Novi novi.leigh@icf.com; Pennington, Rachel rpennington@energycoalition.org; Bruder, Code cbruder@energycoalition.org; Olsen, Tim tolsen@energycoalition.org; Bonto Alina abonto@energycoalition.org; Terry, Patricia pterry@redwoodenergy.org; Smith, Sam ssmith@redwoodenergy.org; Elias, Jane jelias@bayareametro.gov; Cooper, Ben bcooper@stopwaste.org; Chitnis, Sheetal schitnis@aeacleanenergy.org; Harvey, Amanda AHarvey@frontierenergy.com; Barba, Nancy NBarba@frontierenergy.com; Marchant, Margaret mmarchant@frontierenergy.com; Dirr, Nick ndirr@aeacleanenergy.org; ajones@frontierenergy.com; Farber-Eger, Jesse JFarber-Eger@frontierenergy.com; Druyon, Benjamin bdruyon@wrcog.us; Vallery, Qua qvallery@mcecleanenergy.org; Singh Jr., Harpreet H1ST@pge.com; TNelson@frontierenergy.com; ecarter@frontierenergy.com; Christian, Roy M. RMChristian@socalgas.com; Farid, Mori A MFarid@socalgas.com; Gonzalez, Sandra D SGonzalez9@socalgas.com; Montoya, Arturo E AMontoy2@socalgas.com; Bush, Sara E SEBush@socalgas.com; Pidgeon, Dan Dan.Pidgeon@dnv.com; Murray, Rachel Rachel.Murray@dnv.com; Ahn, Hannah Hannah.Ahn@dnv.com; McWilliams, Jen Jennifer.McWilliams@dnv.com; rhausheer@energycoalition.org

CC: Leanne Hoadley, Energy Division, CPUC; Amy Reardon Energy Division, CPUC; George Tagnipes, Energy Division, CPUC

From: Peter Biermayer P.E., Utilities Engineer, Energy Division, CPUC

Subject: Revised Guidance for Large Commercial Heat Pump Water Heater, Commercial and Multifamily, Fuel Substitution Measure Package SWWH028 for Capacity and Energy Savings claims

Summary

The purpose of this memo is to update and clarify guidance on allowable capacity-based savings claims for heat pump water heating (HPWH) equipment for Program Year (PY) 2024 and 2025 claims. Specifically, this guidance addresses claimable savings for commercial heat pump water heaters, referencing the Large Commercial Heat Pump Water Heater, Commercial and Multifamily, Fuel Substitution measure package (SWWH028).

The CPUC issued a previous guidance memo¹ on February 26, 2025, covering this topic and outlining requirements to submit a measure package update utilizing EnergyPlus modeling for commercial buildings. That guidance was issued to address concerns that capacity values used to estimate savings could lead to overstated energy savings.

However, given the complexity and time required to develop and implement the model-based updates, this updated guidance seeks to better align capacity-based saving claims with the current DEER Water Heater Calculator-based saving estimates and provides revisions to the February guidance, along with additional interim guidance.

Guidance Overview and Timeline

- **CPUC Limited Exception Allowed from January 1, 2024 – April 4, 2024.** CPUC Staff will allow Program Administrator's (PA) energy savings claims using a value based on the ENERGY STAR capacity value of 176 kBtu/hr for A. O. Smith CAHP-120. On April 4, 2024, ENERGY STAR removed the A.O. Smith model CAHP-120 from the ENERGY STAR qualification list. The 176 kBtu/hr was a major calculation error within ENERGY STAR. While it should have been obvious if sufficient due diligence was performed by the PAs, staff will allow the ENERGY STAR published value.
- **Allowed from April 5, 2024 – December 31, 2024.** For CAHP-120, CPUC will temporarily allow a capacity value based on the combined heat pump, electric resistance, and storage capacities. Based on the manufacturer specification the total capacity was determined to be 161.8 kBtu/hr, which is almost the sum of the following three capacities: heat pump compressor capacity of 41,699 Btu/hr, heating element capacity of 40,946 Btu/hr, and storage capacity of 79,703 Btu/hr. This was based on an inlet water temperature of 40 F. Refer to methods allowed for the period starting January 1, 2025, for other similar equipment during this period.
- **Allowed January 1, 2025– July 31, 2025.** For integrated heat pumps the CPUC will temporarily allow a capacity value for savings claims based on the combined heat pump compressor, electric resistance and storage tank volume, **but the storage tank value must be adjusted based on the coldest inlet water temperature for the climate zone under consideration.** For a capacity-based claims methodology widely applicable to various qualifying equipment, refer to the approved and published PY2025 SWWH028 measure package, version -06.² Table 1 provides the allowed per-gallon storage tank capacity to be used for integrated equipment saving claims, to calculate the claimable storage tank capacity, multiply this value by the nominal tank storage volume (in

¹ <https://cedars.cpuc.ca.gov/deer-resources/deemed-measure-packages/guidance/resource/32/history/>

² <https://www.caetrm.com/measure/SWWH028/06/>

gallons), as specified by the manufacturer. PAs should do due diligence to ensure realistic customer expectations of energy savings.

Table 1 Integrated Storage Capacity per Nominal Storage Volume by Climate Zone³

Climate Zone	Storage Capacity per Nominal Storage Volume (kBtu/gallon)
1	0.6134
2	0.5896
3	0.5746
4	0.5663
5	0.5746
6	0.5413
7	0.5386
8	0.5333
9	0.5407
10	0.5619
11	0.5856
12	0.5809
13	0.5750
14	0.5883
15	0.5059
16	0.6562

- **Effective between August 1, 2025, and when the revised PY 2026 measure package is approved.** CPUC will allow an interim capacity value for energy savings claims **based on heat pump compressor capacity and storage tank volume capacity.** Table 2 provides the allowed per-gallon storage tank capacity to be used for integrated equipment saving claims; to calculate the claimable storage tank capacity, multiply this value by the nominal tank storage volume (in gallons), as specified by the manufacturer. The PA or implementor have the option of going through the custom project review (CPR) process, until the revised measure package is approved.
- The CPUC encourages installations of equipment with higher compressor-based capacity (rather than electric element capacity) and requires that capacity is based in part on the heat pump compressor capacity, and not the heating element capacity, when establishing total equipment capacity for energy savings claims.
This interim guidance will remain in effect until the measure package is updated to use EnergyPlus modeling.

³ Source: calculated from data in manufacturer specification for A.O. Smith CAHP-120, publication AOSWZE55000. See Discussion section for calculation details.

Table 2 Integrated Storage Capacity per Nominal Storage Volume by Climate Zone

Climate Zone	Storage Capacity per Nominal Storage Volume (kBtu/gallon)
1	0.5781
2	0.5545
3	0.5397
4	0.5315
5	0.5398
6	0.5068
7	0.5041
8	0.4989
9	0.5062
10	0.5272
11	0.5506
12	0.5459
13	0.5401
14	0.5532
15	0.4718
16	0.6204

Note, the basis for Table 2 parameters is the DEER Water Heater Calculator, while the basis for Table 1 is manufacturer specifications sheets for model CAHP-120.

Exceptions during this time period may result in a change of measure package values prior to a new measure package based on EnergyPlus models. These include:

- The manufacturer specifications change (this would be considered remediating an error).
- Change in the ENERGY STAR values (allowed in mid-cycle per resolution and would also be considered correcting an error).
- Any other compelling reason the CPUC finds necessary to require a change, including a change in corrections to a water heater calculator or change to EnergyPlus to determine energy savings and capacity.
- **Changes within this time period, due to the exceptions listed above are effective 90 days after a mandated change by CPUC staff.**
- Additional heat pump water heater models meeting the capacity requirements may affect the measure package or may require adjustments for models having different efficiencies.
- CPUC staff will allow splitting large systems into smaller loops/systems under any PY2025 measure package until the revised PY2026 measure package, if applicable, is approved. The PY2026 measure package shall comply with 2025 Title 24 requirements.
- **PAs will submit a revised measure package with a target completion date 90 days after the EnergyPlus prototypes are published.** CPUC staff is currently updating the EnergyPlus prototypes to support this effort and expects to complete these updates by the fourth quarter of 2025. These updates, to be completed with assistance from measure package developers, will include EnergyPlus models with appropriate heat pump performance curves, building-type specific water heating loads and configurations, and other relevant assumptions to support accurate savings estimates. EnergyPlus models will be released for selected building types as they become available. Measure package developers will then complete measure package revisions using the

prototypes. Additional details surrounding this effort are described below under the Discussion section, including coordination with CPUC staff.

- **Ninety days after a revised measure package is approved by CPUC staff.** A revised measure package based on EnergyPlus will be effective 90 days after CPUC staff approval. The capacity and energy savings will be determined by the revised measure package.
 - CPUC staff believes in many cases the allowed capacity discussed above could potentially overstate the energy savings, but it will depend on the application and sizing of the water heater.
 - Sizing guidance should be included in the measure package to maximize the heat pump-only performance (efficiency mode).
 - Southern California Edison should work with CPUC staff on details of the EnergyPlus model and input parameters.
 - Future EM&V studies will be encouraged to further adjust the measure package.

Background

PAs initially requested guidance on using capacity of 176 kBtu/hr for a specific commercial HPWH the A.O. Smith CAHP-120, based on an ENERGY STAR product listing that was available through April 4, 2024.

Following the removal of this listing from ENERGY STAR, guidance was requested to instead allow the use of manufacturer specifications beginning April 5, 2024 through December 31, 2024.

The CAHP-120 model can operate its heat pump and two electric heating elements simultaneously, resulting in a higher total capacity. The CAHP-120 model storage tank may provide extra persistent capacity, depending on system configuration. The SWWH028 measure package has been interpreted by PAs to permit saving claims based on the use of a combined capacity for integrated units, based on manufacturer specifications or the ENERGY STAR listing. Based on manufacturer specifications, the proposed total capacity for the CAHP-120 is the sum of:

- Heat pump compressor capacity: 41,669 Btu/hr
- Heating element capacity: 40,946 Btu/hr
- Storage capacity: 79,703 Btu/hr

This results in a combined capacity of 162,318 Btu/hr, which has been used in some savings claims.

The current SWWH028 measure package allows for the use of all three capacity components using manufacturer's specifications for integrated heat pump water heaters like CAHP-120. However, CAHP-120 is not currently listed in the U.S. Department of Energy (DOE) Compliance Certification Management System (CCMS) database for commercial water heaters, therefore we are unable to use this independent source to verify ENERGY STAR or manufacturer-based capacity values.

In contrast, the DEER Water Heater Calculator, which is currently used by SWWH028 to estimate savings for commercial heat pump water heaters, incorporates only two components in its equipment sizing assumptions:

- Heating element capacity
- Storage capacity

This difference indicates a lack of alignment between the measure package interpretation and the underlying calculations. As a result, using the higher total capacity that includes the heat pump component—in addition to the two components used in the DEER Water Heater Calculator—may lead to overstated savings. We also find that there may be additional reasons for overstated savings, based on both field and laboratory studies.

This memo provides additional interim guidance on how to determine the claimable capacity of commercial heat pump water heaters when using SWWH028.

Discussion

The existing SWWH028 measure package does not explicitly address scenarios where both the heat pump and dual heating elements can operate simultaneously in response to hot water heating loads. Related to this, the measure package does not currently address the equipment installed capacity relative to hot water heating loads for participating installations. Depending on how the equipment is sized, equipment such as the AO Smith model CAHP-120 may run very efficiently using the heat pump to heat water or may rely more on the heating elements to heat water which compromises the overall efficiency of the installed equipment and could lead to performance that does not align with the intended efficiency criteria. The efficiency of the water heater will also decrease when operating at temperatures lower than the test procedure specified ambient temperature.

CPUC Guidance provides clarity on each of the issues identified in the background section of this memo and clarifies allowed savings claims.

Guidance for ENERGY STAR Capacity-Based Savings Claims. CPUC staff has concluded that while the capacity from the removed ENERGY STAR product listing should not be used as a basis for claims, staff will allow PA's energy savings claims from January 1, 2024 – April 4, 2024, when it appears that ENERGY STAR used an incorrect heat pump input of 12 kW—rather than the actual 2.84 kW input—in the following formula, artificially inflating the capacity estimate:

Heat pump output (kBtu/hr) = Heat pump input (kW) * Heat pump COP * kW-to-Btu conversion factor

176 = 12 * 4.3 * 3.412142

This approach clearly does not represent the true combined capacity of the heat pump, heating elements, and storage tank volume, and provides an erroneous estimate of heat pump compressor capacity using an incorrect input kW.

Furthermore, the SWWH028 measure package does not explicitly allow for the use of the previously published capacity value from ENERGY STAR sources; the measure package allows the use of ENERGY STAR to obtain heat pump efficiency (coefficient of performance - COP).

Guidance for Temporary A.O. Smith CAHP-120 Manufacturer Capacity-Based Savings Claims from January 1, 2025, through July 31, 2025. CPUC staff accept the approach of claiming the combined capacity based on manufacturer's specifications, based on the sum of the output of the heat pump compressor, heating elements and tank storage volume. However, staff do not approve using an inlet water temperature from the manufacturer of 40°F to calculate storage tank volume capacity for all climate zones starting in PY2025. According to the DEER Water Heater Calculator, the minimum observed temperature (taken from all days in the year) varies significantly across California climate zones (ranging from 40.4°F to 63.1°F). For example, the A.O. Smith CAHP-120 specifications indicate different tank capacities depending on inlet temperature:

- 55,171 Btu/hr at 70°F
- 63,119 Btu/hr at 60°F
- 71,079 Btu/hr at 50°F
- 79,073 Btu/hr at 40°F

A unique climate zone storage tank capacity value has been determined using linear interpolation based on the

observed minimum temperature taken from all days in a year, in each climate zone. For a capacity-based claims methodology widely applicable to various qualifying equipment, refer to the published PY2025 measure package approved April 8, 2025. Equipment eligibility and capacity-based claims allowances for SWWH028-06 are described in more detail in the attachment included below.

Where eligible, heat pump savings claims for PY2025 through July 31, 2025, can use the resulting combined (heat pump compressor, elements and storage tank volume) capacity by climate zone.

Guidance for Savings Claims starting August 1, 2025. CPUC staff will allow the combined output of the heat pump compressor and tank storage volume for the purpose of deriving savings claims. Heat pump compressor-based capacity shall be based on manufacturer specifications tested in accordance with DOE 10 CFR 431 Subpart G, and use of heating element-based capacity will no longer be allowed. The tank storage volume-based capacity is based on assumptions used in the DEER Water Heater Calculator, in conjunction with manufacturer specifications for the storage tank nominal volume in gallons. The storage tank volume component of capacity is a function of nominal tank storage volume (in gallons) and climate zone. CPUC staff have estimated tank storage capacity in kBtu/hr-gallon by climate zone based on equipment sizing calculations used in the DEER Water Heater Calculator, as listed in Table 2 above. Equivalent equipment capacity is ensured in the DEER Water Heater Calculator for various modeled equipment as a function of, for example, gas system tank storage capacity and burner output capacity, heat pump system tank storage capacity, and electric element output capacity. Tank storage capacity estimates are based on the product of the following parameters:

- Storage tank volume in gallons
- 0.8 tank utilization factor
- 8.2 Btu/gallon-deg F
- Temperature differential between the 135 deg F tank temperature and the minimum inlet temperature by climate zone

Savings claims effective August 1, 2025, and all savings claims leading up to the next measure package update, can use the resulting combined (heat pump compressor and storage tank volume) capacity by climate zone.

Guidance for Updating SWWH028 Measure Package. CPUC staff requires that the PAs resubmit measure package SWWH028 – updated with the use of EnergyPlus models to replace the use of the DEER Water Heater Calculator in the current version of the measure package. Note that the current measure package has transitioned partially to EnergyPlus for multifamily building types. The work to be completed for this required measure package update will be for similar updates for commercial building types.

The revised measure package update should be submitted 90 days after the EnergyPlus prototypes are published. Measure package savings will be based on EnergyPlus models with a heat pump performance curve. Measure package developers and the CPUC will work cooperatively to achieve this goal, with CPUC leading efforts on prototype development in support of those efforts.

Guidance for Heat Pump Water Heater Sizing Requirements. CPUC staff requires that the PAs revise the heat pump water heater sizing requirements for both the modeling and measure package updates. PA modeling and measure package updates are to be completed in cooperation with and with guidance from CPUC staff. The measure package will explicitly address equipment sizing. Equipment sizing should be based on minimizing operation in a water heater mode using electric resistance heating.

This focus on equipment sizing is needed to address the potential of heat pump equipment efficiency degradation that can be introduced by heating elements. We recommend that the PAs perform additional research and collect independent testing data, including M&V, to improve our understanding of heat pump water heater performance in participating customer installations, and to help ensure robust 2026 claims based, in part, on a more accurate measure package.

Guidance for Indoor Heat Pump Evaporator Equipment Mechanical Room Volume and Ventilation. CPUC staff require that the PAs revise the heat pump water heater storage space and ventilation requirements for both the modeling and measure package updates. PA modeling and measure package updates are to be completed in cooperation with and with guidance from CPUC staff. The measure package will explicitly address storage space volume requirements. Equipment performance can be compromised based on mechanical room size and ventilation as discharge air from the evaporator coil cools those spaces.

The heat pump water heater must meet the storage capacity, heating output capacity, and minimum efficiency requirements set forth in the Measure Case Description section.

It is understood that central domestic hot water systems in commercial or multifamily buildings often consist of one or more heat pumps connected to one or more storage tanks. Efficiencies, capacities, and other operating parameters for these types of systems differ from their individual components and vary based on system configurations and local conditions. However, this system level information is often not readily available. Therefore, for this measure package, the COP at full output capacity of the individual heat pump units shall be used to establish if the equipment meets measure efficiency requirements. Measure offering selections, based on storage volume and/or heating capacity, and incentivized output capacity should be calculated using the total number of eligible heat pump water heaters participating in the incentive. Tanked, split system, and standalone (i.e. instantaneous or tankless) heat pumps are eligible for this measure package and are required to provide the same product eligibility information. Tankless and split HPWH technologies should claim offerings based on their specific efficiency (UEF or COP) and connected storage volumes, and the baseline system eligibility.