

RTR Appendix

Southern California Edison, Pacific Gas and Electric, Southern California Gas, and San Diego Gas and Electric (“Joint Utilities” or “Joint IOUs”) developed Responses to Recommendations (RTR) contained in the evaluation studies of the 2013-2015 Energy Efficiency Program Cycle. This Appendix contains the Responses to Recommendations in the report:

<i>RTR for the Impact Evaluation Report: Home Upgrade Program—Residential Program Year 2017</i> (DNV GL, Calmac ID #CPU0191.01)
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The RTR reports demonstrate the Joint Utilities’ plans and activities to incorporate EM&V evaluation recommendations into programs to improve performance and operations, where applicable. The Joint IOUs’ approach is consistent with the 2013-2016 Energy Division-Investor Owned Utility Energy Efficiency Evaluation, Measurement and Verification (EM&V) Plan¹ and CPUC Decision (D.) 07-09-043².

Individual RTR reports consist of a spreadsheet for each evaluation study. Recommendations were copied verbatim from each evaluation’s “Recommendations” section.³ In cases where reports do not contain a section for recommendations, the Joint IOUs attempted to identify recommendations contained within the evaluation. Responses to the recommendations were made on a statewide basis when possible, and when that was not appropriate (e.g., due to utility-specific recommendations), the Joint IOUs responded individually and clearly indicated the authorship of the response.

The Joint IOUs are proud of this opportunity to publicly demonstrate how programs are taking advantage of evaluation recommendations, while providing transparency to stakeholders on the “positive feedback loop” between program design, implementation, and evaluation. This feedback loop can also provide guidance to the evaluation community on the types and structure of recommendations that are most relevant and helpful to program managers. The Joint IOUs believe this feedback will help improve both programs and future evaluation reports.

¹ Page 336, “Within 60 days of public release of a final report, the program administrators will respond in writing to the final report findings and recommendations indicating what action, if any, will be taken as a result of study findings. The IOU responses will be posted on the public document website.” The Plan is available at <http://www.energydataweb.com/cpuc>.

² Attachment 7, page 4, “Within 60 days of public release, program administrators will respond in writing to the final report findings and recommendations indicating what action, if any, will be taken as a result of study findings as they relate to potential changes to the programs. Energy Division can choose to extend the 60 day limit if the administrator presents a compelling case that more time is needed and the delay will not cause any problems in the implementation schedule, and may shorten the time on a case-by-case basis if necessary to avoid delays in the schedule.”

³ Recommendations may have also been made to the CPUC, the CEC, and evaluators. Responses to these recommendations will be made by Energy Division at a later time and posted separately.

Response to Recommendations (RTR) in Impact, Process, and Market Assessment Studies

Study Title: Impact Evaluation Report: Home Upgrade Program—Residential Program Year 2017
Program: Home Upgrade
Author: DNV GL
Calmac ID: CPU0191.01
Link to Report: http://calmac.org/publications/CPUC_GroupA_Res_PY2017_HUP_toCALMAC.pdf

Item #	Sec. #	Findings	Best Practice / Recommendations (Verbatim from Final Report)	Recommendation Recipient	PG&E (if applicable)		SCE (if applicable)		SCG (if applicable)		SDG&E (if applicable)	
					Disposition	Disposition Notes	Disposition	Disposition Notes	Disposition	Disposition Notes	Disposition	Disposition Notes
				If incorrect, please indicate and redirect in notes.	Choose: Accepted, Rejected, or Other	Examples: Describe specific program change, give reason for rejection, or indicate that it's under further review.	Choose: Accepted, Rejected, or Other	Examples: Describe specific program change, give reason for rejection, or indicate that it's under further review.	Choose: Accepted, Rejected, or Other	Examples: Describe specific program change, give reason for rejection, or indicate that it's under further review.	Choose: Accepted, Rejected, or Other	Examples: Describe specific program change, give reason for rejection, or indicate that it's under further review.
1	7.3	Free-ridership continues to be a significant issue for the program. Overall free-ridership for HUP and AHUP for program year 2017 is estimated at 38%.	The level of free riders at 38% has implications for targeting future participants. Program savings can be improved by targeting customers who fit the following descriptors: live inland, implement larger upgrades with 7 measures or more, and are candidates for the advanced path program.	All IOUs	See Attachment A	See Attachment A	Other	Program discontinued.	Accepted	To reduce free-ridership, SoCalGas plans to target geographically in future marketing campaigns. Furthermore, SoCalGas has over 30 contractors currently participating in the program that canvass areas that include customers who live inland, are candidates for the Advanced Path. It has always been SoCalGas' goal to maximize the number of upgrades; however, opportunities can be limited for a single-fuel utility to implement upgrades with 7 or more measures.	Other	SDG&E will consider these recommendations while evaluating RFPs.
2	7.3	Percent savings for electricity are consistently lower than for gas and have remained largely unchanged over time. Program staff interviews, and customer responses indicate increased heating/cooling load to improve comfort. Electrification trends such as heat pumps that deliver both heating and cooling further add to electric load for fuel switching customers, resulting in lower than forecasted program savings.	Forecasted savings calculations should factor in implementation of HVAC measures. Any departures from default hours of use assumptions and potential changes to households' baseline use should be factored in as well.	All IOUs	See Attachment A	See Attachment A	Other	Program discontinued.	Other	SoCalGas believes this recommendation relates more to electricity than gas and defers this response to the electric IOU's. HUP does not allow non-cost effective fuel switching measures unless they pass the 3 prong test that is currently in place.	Other	SDG&E will consider these recommendations while evaluating RFPs.

3	7.3	Realization rates for AHUP do not show much change over time. The tools approved under CalTest that were supposed to address the problem of inflated energy savings provided by EnergyPro still provide inflated forecasts.	Forecasted savings calculations should factor in implementation of HVAC measures. Any departures from default hours of use assumptions and potential changes to households' baseline use should be factored into forecasts as well.	All IOUs	See Attachment A	See Attachment A	Other	Program discontinued.	Accepted	The implementation of HVAC measures is factored into the forecasts, but not specifically default hours. SnuggPro currently accounts for occupancy, window venting, default efficiencies, t-stat setpoints, as well as bill calibration which could mold and affect assumed hours.	Other	SDG&E will consider these recommendations while evaluating RFPs.
4	7.3	The trend of increasing solar photovoltaic (PV) adoption has implications for future evaluations of HUP and AHUP and pay for performance programs (programs with incentives based on normalized metered energy consumption). Billing data does not currently provide a measure of energy consumption that includes the share from self-generation.	PAs/program implementers should consider devices to measure energy production at the customer site and linking measurements to billing data. This will enable an accurate measurement of energy consumption from the household load for net-metered customers. Future waves should factor in solar and EV adoption when forecasting expected savings and in the models to estimate savings.	All IOUs	See Attachment A	See Attachment A	Other	Program discontinued.	Other	This recommendation does not apply to SoCalGas since on-site energy production and net metering is strictly an electric issue.	Other	SDG&E will consider these recommendations while evaluating RFPs.

ATTACHMENT A
PG&E RTR Responses – Advanced Home Upgrade (PGE21004)

The Impact Evaluation report provides a helpful guide for PG&E as we continually strive to offer better products, transform energy efficiency markets, and serve as good stewards of ratepayer dollars. PG&E responds to the recommendations from this report and discusses below what we have done, continue to do, and plan to do to address them.

Per Energy Upgrade California (EUC)'s website, EUC "was created to motivate and educate California residents and small businesses about energy management" and "is a statewide initiative committed to uniting Californians to strive toward reaching our state's energy goals."¹ PG&E's Advanced Home Upgrade (AHUP) program has been in existence since 2013 and retrofitted 15,094 homes to date (in addition to 7,853 homes retrofitted under the sunsetted Home Upgrade basic pathway). On April 1, 2019, PG&E instituted a series of changes to redesign its AHUP program offering which are described in greater detail below.

1. FINDING: *Free-ridership continues to be a significant issue for the program. Overall free-ridership for HUP and AHUP for program year 2017 is estimated at 38%.*

RECOMMENDATION: *The level of free riders at 38% has implications for targeting future participants. Program savings can be improved by targeting customers who fit the following descriptors: live inland, implement larger upgrades with 7 measures or more, and are candidates for the advanced path program.*

DISPOSITION: ACCEPT with some qualifications: We accept the recommendation with the exception of changing program requirements by raising the minimum number of measures.

First, we appreciate DNV GL for introducing the concept of a prorated measurement of partial free-ridership. This is a significant refinement over prior cycles that used a single catch-all response to capture partial free ridership. However, we believe that further work is needed on the net-to-gross battery.

We believe that the finding of 38% free-ridership is likely to be an over-estimate of the percentage of program participants that would have undertaken permitted, above-code, comprehensive retrofits of their homes — key objectives of the programs. We base this belief on the following:

- We maintain that Home Upgrade programs have few free-riders. The Program forces a customer to do things most would not have done without the incentive: pull a permit, get a Combustion Appliance Safety (CAS) test, install above-code equipment, and use a BPI-certified professional. According to the "2014-16 HVAC Permit and Code Compliance Market Assessment" performed by DNV-GL, from 8% to 29% of the retrofit installations that required a permit were permitted². A 2017 report published by the California Energy Commission estimates that fewer than 10% of California homeowners pull permits for the installation of HVAC systems.³ It is conceivable that without program intervention, customers would not make these changes. Every AHUP program participant received a permit to install the retrofit upgrades and would likely not have done so without the program.
- The report does not provide the percentage of participants that, when surveyed, indicated that they made a single decision to undertake the entire package of measures in the upgrade that would have been "very unlikely" or "somewhat unlikely" to have undertaken the project without the program.
- When assessing free-ridership, the report does not address the critical issue of *whether the program was necessary in the decision-making process* to undertake the upgrades comprising the program. We believe that the program being a necessary element in the decision-making process should be regarded as being equally as important as whether the customer decision *was motivated solely by the program*.
- The Report does not provide the estimated percentage of program participants seen as "total/pure" free-riders—that is, the percentage that received a zero score on either the short- or long-form question battery. The Report only provides results of a "sensitivity analysis examining free-ridership under the extreme boundary conditions" where partial free-ridership was set to either "total free-riders" or "non-free-riders." The result of this analysis is that the free-rider score could be either half as large (19%) as the reported 38% free-ridership score estimated for PG&E, or twice as large (72%). A range from 19% to 72% for an estimate of free-ridership is not informative.

As such, the current rate of homeowner compliance with permitting requirements in the AHUP program far exceeds the CPUC goal of 90% homeowner permit compliance by 2020. This finding suggests the following:

- The 38% free-ridership estimate found by in the 2017 impact evaluation is too high.

¹ <https://www.energyupgradeca.org/our-mission/>

² http://www.calmac.org/publications/HVAC_WO6_FINAL_REPORT_VolumeI_22Sept2017.pdf

³ <https://www.energy.ca.gov/2018publications/CEC-400-2018-003/CEC-400-2018-003.pdf>

A comprehensive measurement of free-ridership would involve identifying a group of non-participants that have undertaken similar comprehensive retrofits outside of the AHUP program. This would allow for the comparison of rates of permit compliance, CAS safety test completion, use of BPI-certified installers, and the installation of above-code equipment. Identification of such a comparison group would be enormously difficult, because only programs such as HUP and AHUP generate a large number of homeowners to undertake comprehensive home retrofits. This fact should put the free-ridership estimate in a more appropriate context.

As far as working to decrease free-ridership moving forward, PG&E agrees with the recommendations provided and has already taken action. On April 1, 2019, a series of program changes took effect, including efforts to decrease free-ridership, focus on inland customers, and drive volume in AHUP (the advanced pathway), which is the only pathway that PG&E now offers.

To encourage participation from customers in inland regions, PG&E split its climate zones into two groups:

- 1) **Climate Zone (CZ) Group 1 (“Inland”)**: CZs 1, 4, 11, 12, 13
- 2) **Climate Zone (CZ) Group 2 (“Coastal”)**: CZs 2, 3, 5

Based on recent NMEC data, CZ Group 1 includes climate zones that yield higher energy savings, including inland CZs such as the Central Valley. CZ Group 2 includes coastal climate zones that yield lower actual savings.

To drive program participation in inland regions, PG&E now offers higher incentives for customers in CZ Group 1 (“Inland”). For a breakdown of incentive variations per climate zone, see *Table 1 Breakdown of AHUP Customer Incentives* below. Additionally, customers in inland regions are eligible for a higher amount of maximum incentives than those in coastal regions. Maximum incentives per home for each CZ group are:

- 1) **Climate Zone Group 1 (“Inland”)**: \$5,500
- 2) **Climate Zone Group 2 (“Coastal”)**: \$3,500

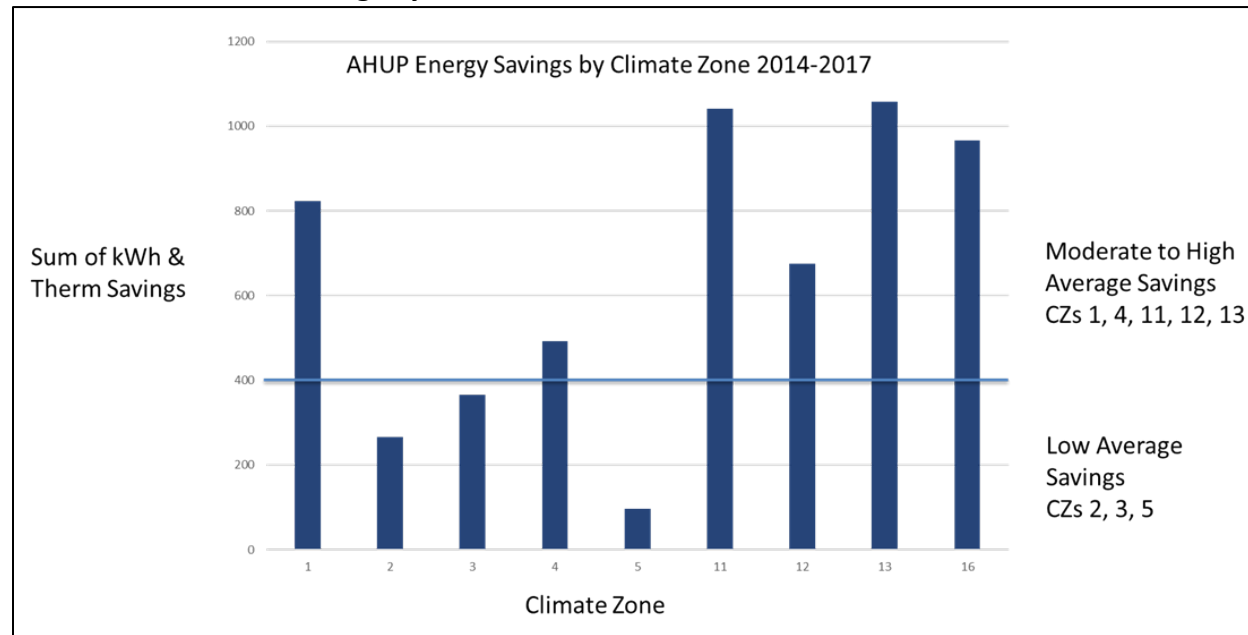
To encourage customers to perform more substantial whole-home retrofits, PG&E sunsetted its Home Upgrade (HUP) basic pathway in May 2018 and now offers customer the AHUP advanced pathway and the Residential Pay for Performance HOPP. Under AHUP, customers are required to install a minimum of four measures, two of which must be shell-related and one HVAC. This minimum measure requirement ensures customers install more measures than they normally would have installed, absent program participation. Aside from measure installation, AHUP provides a range of technical assistance including helping introduce customers to utility tools like *Share My Data* and *My Account*. AHUP also provides customer education surrounding the availability of other utility offerings such as Demand Response and Quality Maintenance programs. Participation in AHUP is a crucial step to putting customers on an energy conservation “customer journey” that they likely would not embark on without the partnership created when the customer joins a comprehensive energy efficiency program such as AHUP.

Table 1: Breakdown of AHUP Customer Incentives

Measure Description	Program Standard	Quantity	Customer Incentive CZs 1, 4, 11, 12, 13, 16	Customer Incentive CZs 2, 3, 5
Shell - Wall insulation	R value ≥ 13 (2x4 framing) or R value ≥ 19 (2x6 framing), installed per CEC QII Standards.	Minimum 50% total wall area (all walls)	\$500	\$300
Shell - Attic Insulation	R-44 or better, installed per CEC QII standards. Existing insulation maximum R19 in CZ 2, 3, 5. Existing insulation maximum R30 in CZ 1, 4, 11, 12, 13, 16.	100% of accessible attic area (minimum 50% of total attic area)	\$500	\$300
Shell - Floor insulation	R value ≥19, installed to full-joint thickness, per CEC QII Standards.	100% of accessible floor area (minimum 50% of total floor area)	\$500	\$300
Shell - Whole building/envelope air sealing and Ventilation	0.35 or better ACHn target, 0.5 ACHn minimum performance, achieved in accordance with BPI standards and ventilated per	800 square foot conditioned area (at 8 ft average ceiling height) minimum		

	ASHRAE 62.2. (installation of balanced Heat Recovery Ventilation recommended)		\$300	\$200
	1) 15% building leakage reduction (pre vs. post)		\$500	\$300
	2) 30% building leakage reduction (pre vs. post)			
HVAC - New Ducts and Insulation	Replacement only; R-8 All CZs @ 5% leakage or less. Existing ducts must be 10% leakage or greater to be eligible for upgrade.	100% of accessible ducts; up to 2 systems per dwelling unit	\$500	\$500
HVAC - Cooling	Split AC: SEER 15.0 / EER 12.5 or better Packaged AC: SEER 15.0 / EER 12.0 or better	Up to 2 HVAC systems (total) per dwelling unit	\$500	\$300
HVAC - Heating	Sealed Gas Furnace: 92% AFUE or better Heat Pump: 9.0 HSPF or better		\$500	\$500
HVAC - Ultimate Comfort	Meet 7 Residential HVAC System Commissioning Specifications including Delivered Sensible EER @ 85% or better (85% Delivered Heat for Furnaces)	One system per dwelling unit	\$1000	\$500
Gas Storage Water Heater	0.70 EF/UEF or better	Up to 2 DHWs (total) per dwelling unit	\$300	\$300
Condensing Gas Storage Water Heater	0.90 EF/UEF (Sealed Combustion)		\$500	\$500
Electric Storage Water Heater	3.24 EF / 3.09 UEF or better		\$500	\$500
Pool Pump	CEC Title 20 compliant variable speed pool pump replacing existing single or two-speed pump (primary in-ground pool system only; no jacuzzis)	One pool pump per project site	\$500	\$500
Smart Thermostat	EnergyStar certified Smart Thermostats. Must be Wi-Fi enabled and confirmed via test login.	Up to 2 per dwelling unit with corresponding HVAC system	\$100	\$100
Lighting	\$5 per pin-base recessed LED retrofit fixture (Title 24 - JA8 Compliant)	Up to 25 per dwelling unit	\$125	\$125
Per-Project Maximum			\$5,500	\$3,500

Table 2: Variation in Savings by Climate Zone



2. FINDING: Percent savings for electricity are consistently lower than for gas and have remained largely unchanged over time. Program staff interviews, and customer responses indicate increased heating/cooling load to improve comfort. Electrification trends such as heat pumps that deliver both heating and cooling further add to electric load for fuel switching customers, resulting in lower than forecasted program savings.

RECOMMENDATION: Forecasted savings calculations should factor in implementation of HVAC measures. Any departures from default hours of use assumptions and potential changes to households' baseline use should be factored in as well.

DISPOSITION: REJECT

Three important things are happening in the market that are reflected in the evaluation's findings that are not reflected in the Report:

- 1) Climate change is driving higher use of heating and cooling equipment in both inland and coastal regions.
- 2) As older equipment is replaced, homeowners are using the new efficient equipment at higher rates, in part because it is more affordable for them to do so. This fact indicates the need to account for changes in HVAC usage in the market as a whole.
- 3) In light of the two foregoing points, changes in customer usage patterns resulting from the installation from more efficient equipment to improve customer comfort, health, and safety are challenging to forecast.

Had the participants been driven to act by the need for a replacement HVAC system (AHUP's program focus is largely on load-reducing shell measures), usage at the site level likely would have been higher had the participant followed typical non-program market behaviors of hiring non-certified installers and installing equipment that typically does not exceed minimum code and/or is unpermitted.

Percent savings calculated by modeling software is no longer a factor in AHUP, as the Program has abandoned software modeling and will be using a combination of more conservative deemed forecasted savings and reporting realized savings at the meter starting April 1, 2019.

3. FINDING: Realization rates for AHUP do not show much change over time. The tools approved under CalTest that were supposed to address the problem of inflated energy savings provided by EnergyPro still provide inflated forecasts.

RECOMMENDATION: Forecasted savings calculations should factor in implementation of HVAC measures. Any departures from default hours of use assumptions and potential changes to households' baseline use should be factored in as well.

DISPOSITION: REJECT with qualifications. PG&E introduced a new High-Performance HVAC Installation measure to, in part, increase HVAC savings. However, given the switch to a model resembling a deemed approach, we cannot change the forecasting algorithm.

In 2018, PG&E conducted its own CalTRACK analysis to evaluate the realization rates of software predicted savings to actual metered energy savings in the AHUP program. The findings made PG&E aware of the low realization rates of the Program, which were attributable in part due to the predictive software being used. On October 4, 2018, PG&E met with the CPUC to discuss the redesign changes, which included eliminating use of the modeling custom software that PG&E determined was inaccurate at predicting savings and was thus judged to be ineffective.

Redesign changes to the Program also included:

1. Lowering incentives for existing measures.
2. Varying incentives by climate zone based on historical energy savings results and potential to save (see *Variation in Savings by Climate Zone Table 2* above).
3. Basing new incentives on an "a la carte menu" that better reflects measured energy savings values.
4. Claiming savings based on historical NMEC averages for the Program, to be trued-up with actuals one year after installation.
5. Eliminating software for the determination of a savings claim and instead basing claimed savings on NMEC-derived historic averages, to be trued-up a year later based on actuals.

The above redesign changes were launched in AHUP on April 1, 2019.

As part of its redesign changes, PG&E introduced a new High-Performance HVAC Installation (HPHI) measure to drive greater comfort, increase savings, improve cost-effectiveness, and develop the contractor workforce. Contractors are required to go through an HPHI-specific training before they are eligible to install HPHI measures in customers' homes.

The addition of the HPHI measure included:

1. Providing a \$500-\$1,000 incentive to the customer for installing HPHI.
2. Providing a \$1,200 kicker to participating installation contractor for selling and installing verified HPHI installations.
3. Providing up to \$4,000 per contractor as a 50:50 cost match for additional training required to perform HPHI.

HPHI is expected to increase metered energy savings but faces challenges to widescale market adoption. The kicker and incentive are designed to address this barrier. PG&E anticipated that 10-15 AHUP contractors (approximately 30%) will initially participate in HPHI. Decreased incentives for non-HPHI projects will be offset by the new HPHI kicker for contractors.

HPHI Participation (as of May 16, 2019):

Paid HPHI Projects	4
Pipeline HPHI Projects	1
HPHI-Approved Contractors	2
HPHI Contractors in Training	3

As the Program continues to learn from NMEC-based savings calculations, it can leverage meter-based savings associated with HVAC savings, incorporating both take-back and baseline usage changes. As focus moves closer to a Pay-for-Performance model, customer targeting by potential to save will result in further improvements to realization rates. Once NMEC moves to a true matched population control group, net energy consumption over true compliance rates and normal replacement should show increased realization rates.

Therefore, we reject this recommendation because we do not believe it can justify the additional cost and complexity to modify the forecasting algorithm to allow customers with PV and/or EVs to participate in AHUP. We believe that a future redesign of the residential Pay for Performance program will be a better long-term solution for such customers.

4. FINDING: The trend of increasing solar photovoltaic (PV) adoption has implications for future evaluations of HUP and AHUP and pay for performance programs (programs with incentives based on normalized metered

energy consumption). Billing data does not currently provide a measure of energy consumption that includes the share from self-generation.

RECOMMENDATION: PAs/program implementers should consider devices to measure energy production at the customer site and linking measurements to billing data. This will enable an accurate measurement of energy consumption from the household load for net-metered customers. Future waves should factor in solar and EV adoption when forecasting expected savings and in the models to estimate savings.

DISPOSITION: ACCEPT

There are a number of ways to monitor Solar PV generation. For example, we currently monitor kWh on Zero Net Energy (ZNE) projects with CTs in electrical panels connected to data-loggers. This approach may be feasible to explore for AHUP. A second approach is to have customers supply PV generation data through their PV supplier. However, a formal way to monitor savings would be to encourage customers to have a net generation output meter (NGOM) installed and to change their electrical billing rate to something favorable to Solar PV generation and/or storage. With storage, there is a real opportunity to set up off-peak consumption and store day-time affordable generation for feeding back to the grid during peak-demand hours. However, this situation would only represent a small subset of AHUP projects due to additional cost and project complexity.