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# TECH Clean California's Response to California Energy Commissionâ€™s 2024 Building Energy Action Plan Workshop

*Additional submitted attachment is included below.*

# TECH Clean California's Response to California Energy Commission's 2024 Building Energy Action Plan Workshop

Docket 23-DECARB-03

Submitted March 26, 2024

VEIC, on behalf of TECH Clean California, respectfully submits comments on the California Energy Commission's (CEC) request for public comment as follow-up to the March 12, 2024 public workshop on the 2024 Building Energy Action Plan. VEIC, a member of the TECH Clean California ("TECH") implementation team, appreciates the opportunity to respond. TECH is a statewide market transformation initiative that aims to help California achieve its greenhouse gas reduction and climate neutrality goals by driving market adoption of low-emissions space and water heating technologies.

The California Energy Commission has solicited feedback on the following technical sections, some of which will be covered through a "full discussion" and some of which will be covered through "limited discussion". We have bolded the technical sections we are providing a response to below:

- Full discussion - Residential
    - Financing
    - **Decarbonizing manufactured housing**
    - **Decarbonizing hard to reach communities**
    - **Residential panel optimization and upsizing**
- Limited discussion - Residential
    - **Bill impact estimation for consumers**
    - **Remediation costs for residential buildings**
    - Tenant protections
    - **Building local workforces**
    - Equity metrics
    - **Zonal decarbonization**
    - Whole-house Home Energy Rating and Labeling
- Full discussion – Combined Residential and Commercial
    - Benchmarking and building performance standards
    - **Heat pump alterations and additions to existing buildings**
- Limited discussion – Combined Residential and Commercial
    - **Data standardization and sharing**
    - Embodied carbon
    - Energy Code compliance
    - Advancing load flexibility
    - Electric vehicle supply equipment retrofits
    - Refrigerant recovery and recycling

## Technical Section: Bill impact estimates for customers

The TECH Clean California team has been working on a Bill Impact Analysis that covers the first tranche of TECH incentives and bill impacts, across 176 homes in PG&E territory (all non-solar). It is based on analysis of metered post-installation usage compared to a carefully constructed counterfactual baseline. Acknowledging that this is a limited data set, and in anticipation of a much larger dataset of meter-based results from TECH heat pump projects across IOU territories this year, the purpose of this initial analysis was to:

- Establish methodology and capabilities for bill impact analysis;
- Develop preliminary results for a first look at heat pump installation outcomes;
- Set the stage for the larger analysis expected later in 2024.

The inputs for this analysis included:

- Residential heat pump installation sites in PG&E service territory;
- Meter data through March 2023;
- Filtered from 2,117 total project sites to 176 sites without rooftop solar, with 12 months of post-installation electricity and gas meter data, and for which an accurate counterfactual could be created.

Results from this initial Bill Impact Analysis will be published on the TECH Clean California website, as this link: https://techcleanca.com/about/reporting/

A presentation on this initial Bill Impact Analysis was given most recently at the California Energy Commission's March 21 Workshop on Inflation Reduction Act Home Efficiency Rebates (HOMES) Program. The presentation slide deck will be posted to the Docket Log (23-DECARB-01).

## Technical Section: Remediation costs for residential buildings

The TECH team is working on a Final Report of Lessons Learned and Pilot Findings from the TECH Clean California San Joaquin Valley Disadvantaged Communities (SJV DAC) Pilot. The overall SJV DAC pilot provided electric appliances to 1,944 qualifying homes without access to natural gas service and that use propane or wood for cooking or heating. Homes that received funding through the overall SJV DAC Pilot Program were eligible for up to $5,000 worth of remediation and minor home repairs, an amount which was seen as sufficient for most homes participating in the pilot. TECH's collaboration with SJV DAC Pilot Project offered up to $10,000 of additional funding for homes with excessive remediation costs, with potential for additional funding available on a case-by-case basis. Through TECH, 89 homes in the SJV DAC were granted additional funding for extensive remediation efforts surpassing the initial $5,000 allocation administered under the IOU pilot program.

Relevant to the Building Energy Action Plan, the below Figures highlight pilot learnings and data around remediation cost ranges for the TECH SJV Pilot and the broad SJV DAC Pilot Program implemented by the CPUC. That includes what measures were included in the scope of remediation work, and data on

the average costs per household of remediation (without a cost cap per home but informing a recommendation for future programs of a program-wide, average home remediation cap of not less than $10,000). **While the underlying data is complete as the pilot has wrapped up, these are DRAFT figures – as the Final Report for this Pilot will be published on the TECH Clean California website in the coming months.** The Final Report will include a broader set of lessons learned and takeaways from pilot implementation.

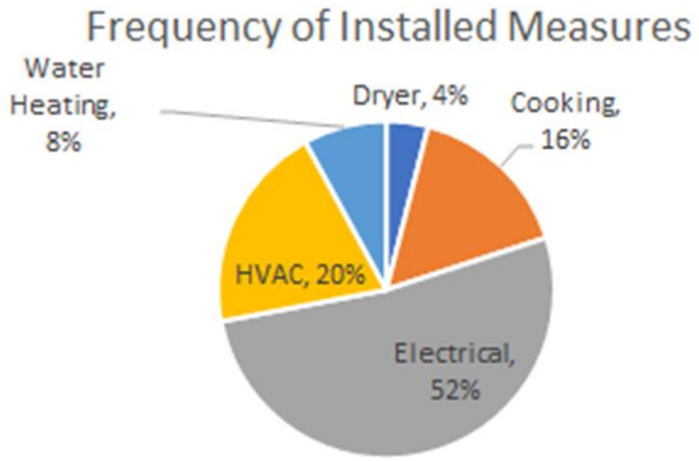


*Figure 1: Frequency of Installed Measures*

Figure 1 demonstrates the frequency of installed measures across pilot projects. As of the end of 2023 (the wrap up of the pilot), the TECH SJV Pilot had provided additional incentive to 89 homes in SCE and PG&E territory. Specific remediation measures differed from site to site; however, they can be categorized as:

- Water Heating (e.g., relocating heaters, modifying enclosures)
- HVAC (e.g., removing appliances, sealing bases and ducts, modifying enclosures)
- Cooking (e.g., removing appliances, adding wiring, filling oven wall cavity)
- Dryer (e.g., upgrading receptacle)
- Electrical (e.g., panel upgrades or relocations, right-sizing conduit, trenching)

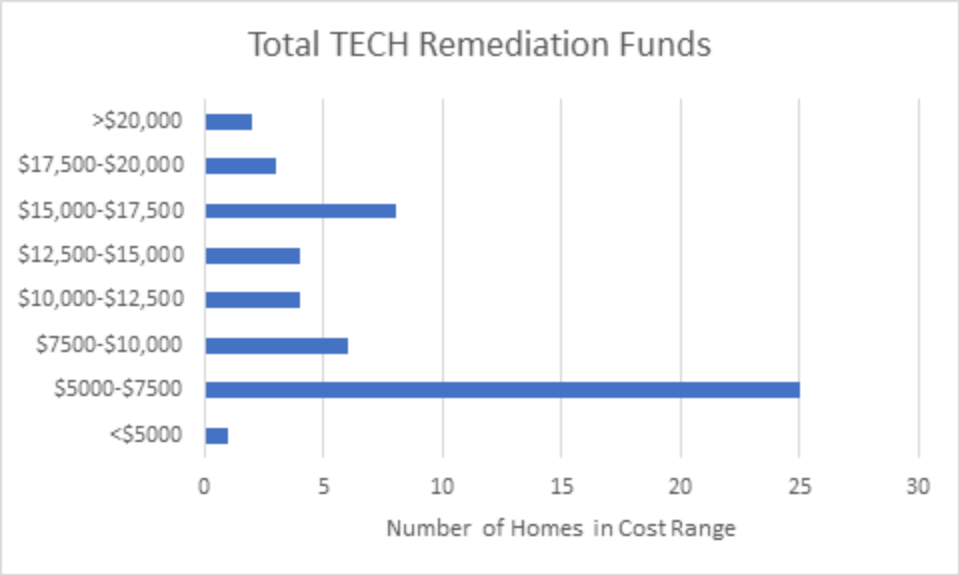


*Figure 2: Total TECH Remediation Funds*

Figure 2 shows the frequency of different cost ranges within the homes supported by TECH. The largest share of homes fell within the $5,000-$7,500 range. However, many homes had higher remediation costs, in some cases significantly higher, with one home costing three times the project's average cost.

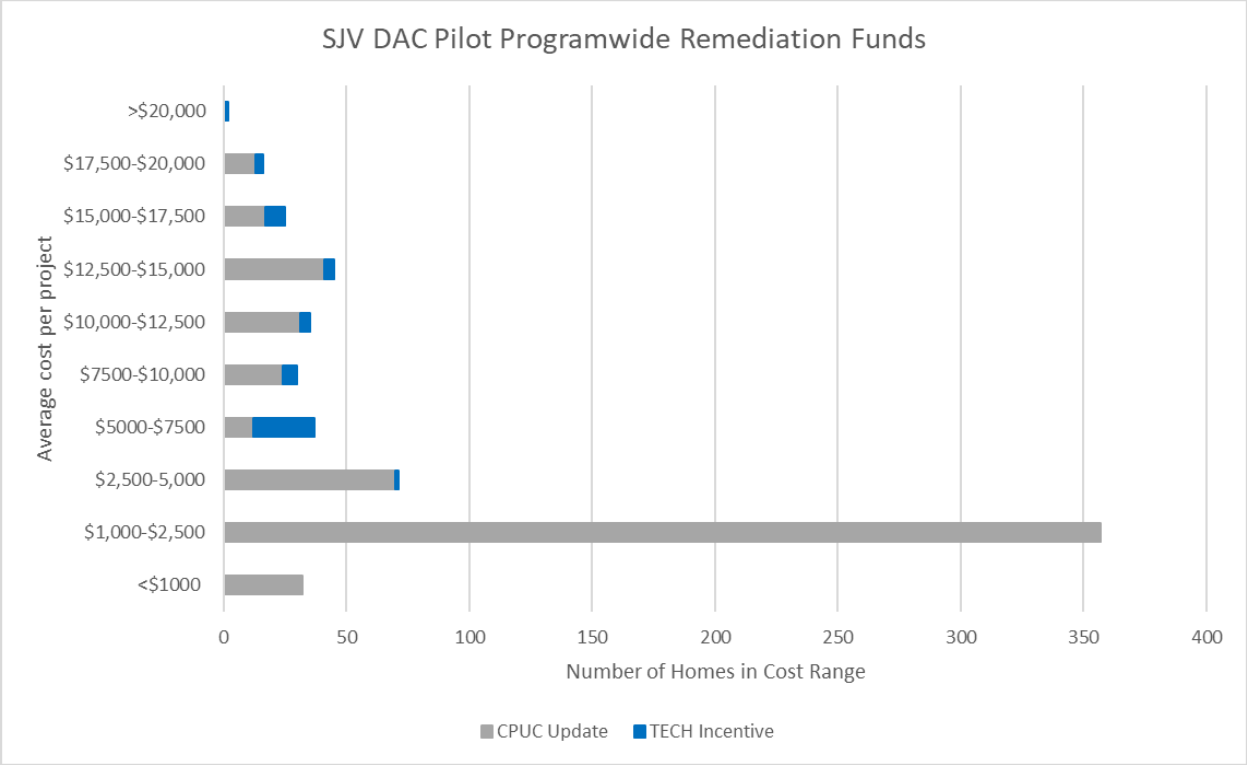


*Figure 3: CPUC SJV DAC Pilot (CPUC Update) vs. TECH Pilot Remediation Funding (TECH Incentive)*

From data available through public reports to the CPUC, the TECH team can see how the total remediation costs for properties served by the CPUC SJV DAC pilot through the second quarter of 2023

compared to those who received TECH funding. Figure 3 represents the number of homes that fell within each of the listed cost ranges, with the grey (CPUC Update) representing projects within the broader CPUC SJV DAC pilot and the blue (TECH Incentive) representing the homes that also received a TECH incentive. As TECH was serving exclusively high remediation cost properties, it is unsurprising that the largest share of properties in the SJV DAC pilot faced lower remediation costs, with a majority needing remediation in the $1000-$2500 range.

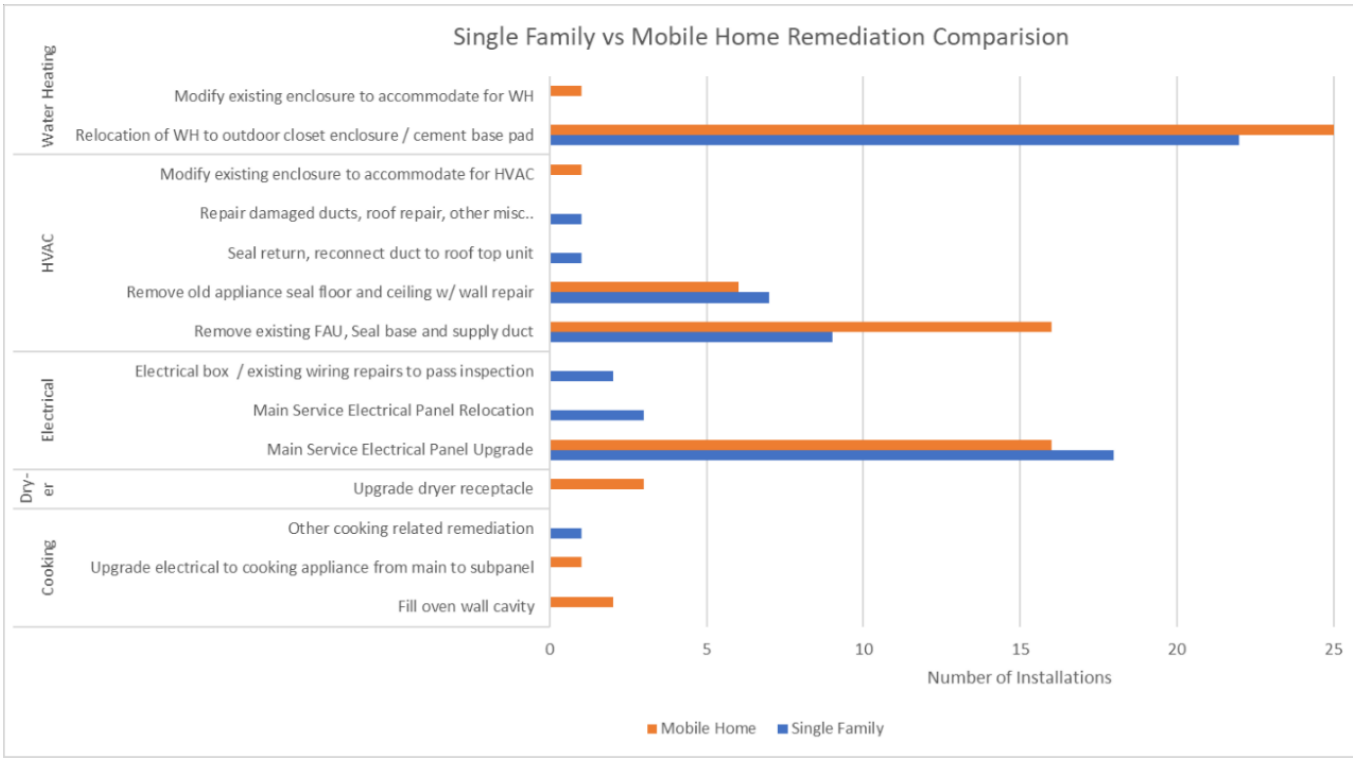


*Figure 4: Remediation Needs by Housing Type*

The frequency of measures was reasonably consistent across housing types for the most common measures, with certain less frequent measures applying to only mobile or single-family homes. Figure 4 shows a detailed breakdown of measures by housing type. The number of measures installed in mobile and single-family homes showed little variation, averaging around six measures for mobile homes and seven measures for single-family homes.

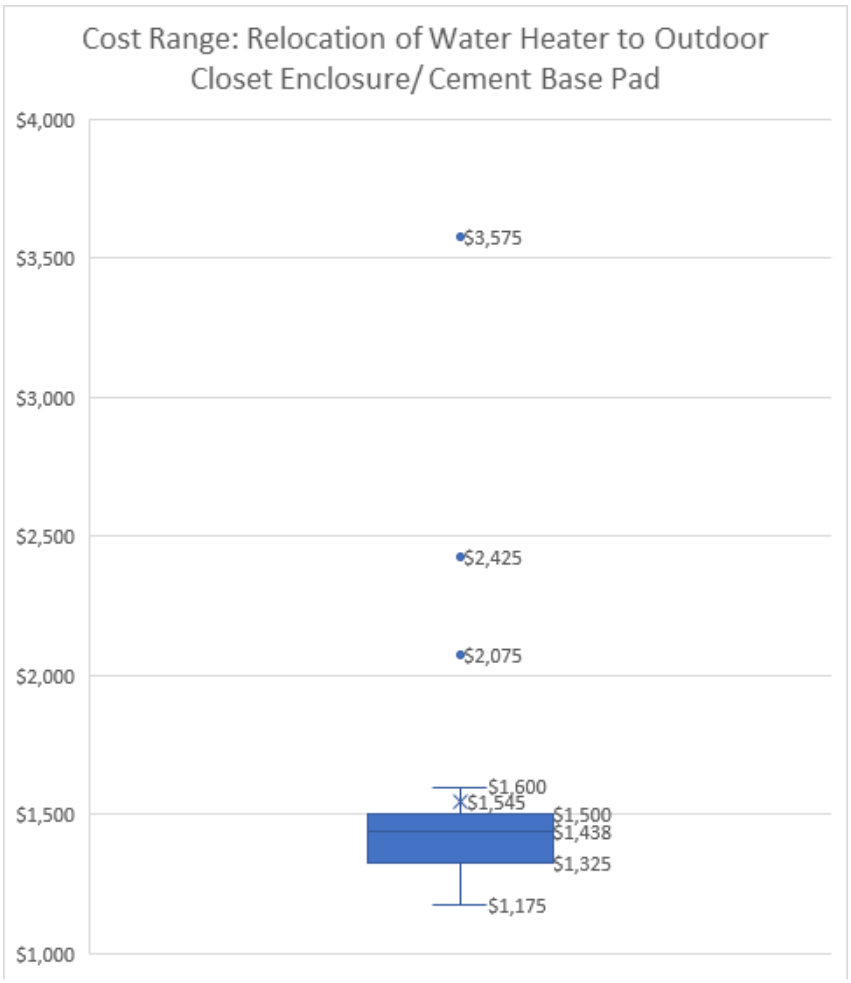


*Figure 5: Cost Ranges of Water Heater Relocation*

Within the Water Heating category, relocating the water heater was the most frequent measure and was implemented in 48 homes. Figure 5 provides cost information on the relocation of water heaters. In the majority of these homes, the costs fell within the range of $1,175 to $1,600, with an average cost of approximately $1,438. However, there were a few outliers at the upper end of the cost spectrum, reaching up to $3,575 for this particular measure. It is noteworthy that the cost of this measure did not exhibit significant variation between mobile homes and single-family homes. The higher costs and presence of outliers for both mobile homes and single-family homes in the context of removing and relocating heat pump water heaters can be influenced by several potential factors.

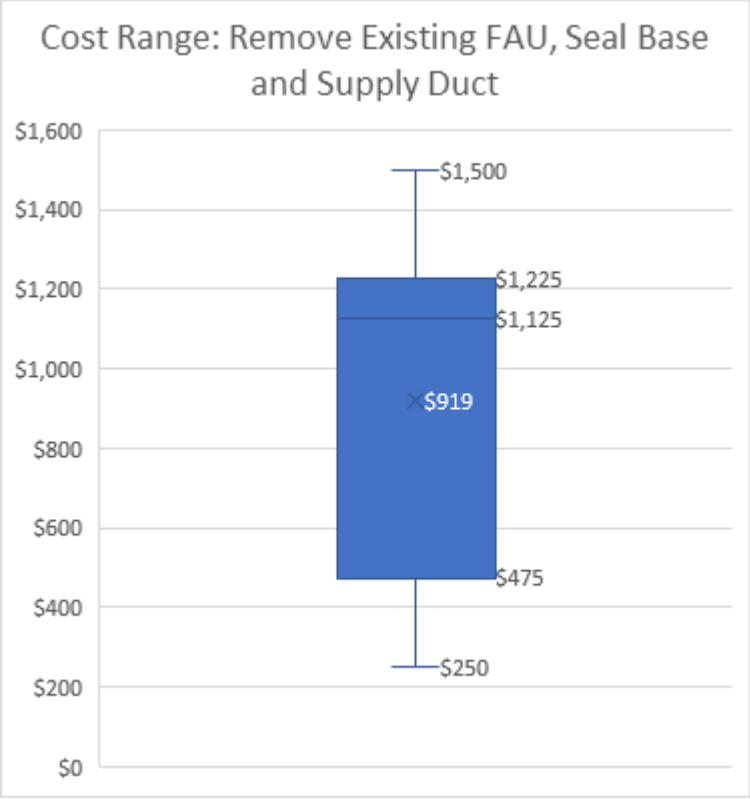


*Figure 6: Cost Range of Removing Existing FAU, Seal Base, and Supply Duct*

Within HVAC, the most common measure involved the removal of the existing forced air unit and subsequent sealing of the base and supply duct. This particular measure was required in 26 homes. As shown in Figure 8, among the middle 50% of homes, the cost variation within this category was more pronounced than the relocation of water heaters ranging from $475 to $1,225. The overall cost spectrum encompassed a range of $250 to $1,500, with an average expense of $1,125. Interestingly, the average cost associated with this measure exhibited no significant disparity between mobile and single-family homes.

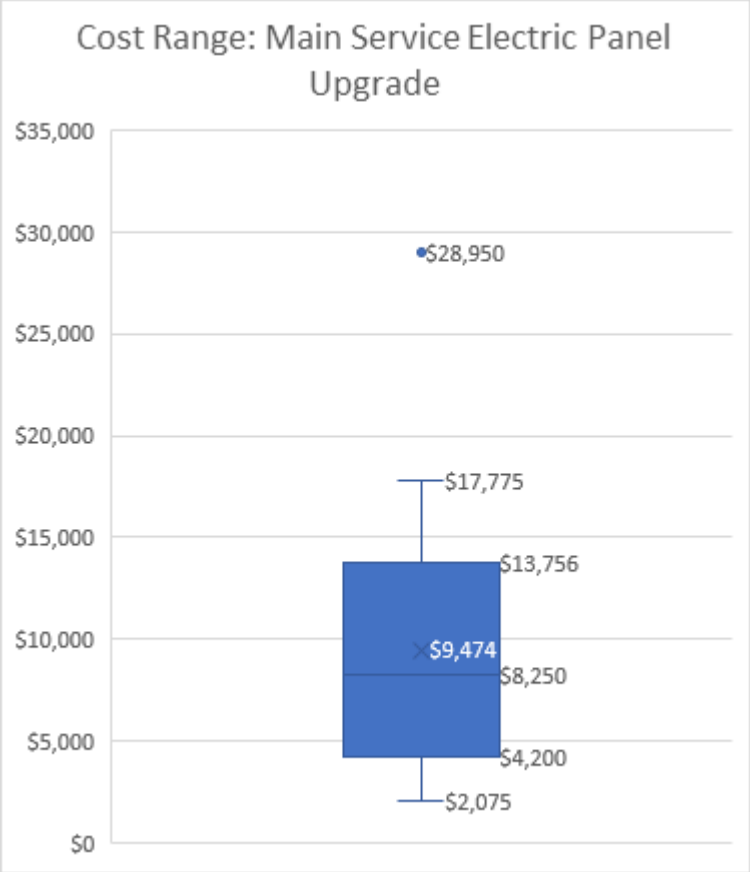


*Figure 7: Cost Range of Main Service Electrical Panel Upgrade*

A total of 34 participating homes received upgrades to their main electrical service panel, encompassing a wide range of costs. As noted in Figure 7, among the homes that underwent this upgrade, 50% reported costs falling within the range of $4,200 and $13,775, with an average cost of $9,475. Notably, one property stood out as an outlier, incurring an unexpected and significant upgrade cost of $28,950. The need to carry out concrete digging before trenching could be performed introduced additional, unanticipated costs. Moreover, it is worth noting that the cost of these upgrades was notably higher for mobile homes, which experienced an average cost of approximately $10,250, compared to an average cost of approximately $8,750 for single-family homes.

## Technical Section: Decarbonizing manufactured housing

In the technical section on “remediation costs for residential buildings” above, the TECH team has included initial data and findings from the TECH Clean California TECH San Joaquin Valley Disadvantaged Communities Pilot. TECH funding supported 89 homes in SCE and PG&E territory, of which 28 were mobile homes. The data outlines several of the installation costs that the pilot faced specific to manufactured housing – including the need for trenching in a mobile home site, which presented an accessibility challenge due to small setbacks between units, compelling manual trenching and

substantially increasing labor expenses. For HPHW installations, the pilot found that the cost of the measure installation did not vary significantly between mobile homes and single-family homes, outliers aside. For electric service panel upgrades, though, the cost of these upgrades was notably higher for mobile homes, which experienced an average cost of approximately $10,250, compared to an average cost of approximately $8,750 for single-family homes in the overall pilot. This disparity in costs emphasizes the specific challenges and unique requirements of upgrading electrical service panels in mobile homes, which can drive up the expenses associated with the necessary remediation work. The Final Pilot Report will be published on the TECH Clean California website in the coming months.

## Technical Section: Decarbonizing Hard-to-Reach Customers

In October 2023, the TECH Clean California program published a report - "Heat Pump HVAC Retrofit Cost Drivers: Impact of project and site features on the total installed cost of heat pump space heating retrofit projects in California single family homes". This report includes data reporting on the cost drivers for the early stages of the TECH Clean California heat pump market transformation program. The data presented in that study is disaggregated across multiple variables, including Hard-To-Reach communities. Sample findings that are relevant to the CEC's information gathering on HTR communities and rural decarbonization cost differentials include:

> "The number of TECH-enrolled contractors serving a county is strongly negatively (-52 percent) correlated with a county's hard-to-reach status as defined by CPUC in Resolution G-3497. A county's hard-to-reach status represents its urban characteristics, so this negative correlation shows that more TECH-enrolled contractors serve urban California counties in the San Francisco Bay Area, Greater Los Angeles Area, Greater Sacramento Area, and Greater San Diego Area. This verifies that the rural counties are in fact harder to reach, at least for TECH-enrolled heat pump HVAC contractors. Some correlation is expected due to a difference in population density, however. A more surprising result of the correlation analysis is that SEER has a strong correlation with multiple site features, but little to none with project features, as shown in Figure 8. The strong correlation of SEER with hard-to-reach county status may be because the larger temperature variation in rural counties of California increases the cost-effectiveness of higher efficiency products compared to the mostly coastal and mild urban counties. However, if this correlation were purely weather-driven, the correlation between SEER and county quantity contractors serving would be less than the correlation between SEER and hard-to-reach county status. The higher correlation between SEER and county quantity contractors serving suggests that when more TECH-enrolled contractors serve a county, this decreases the average SEER of heat pump HVAC retrofits for more than just geographic reasons."[1]

The TECH team encourages the CEC to incorporate and consider the data collected and published in that report, which can be found on the TECH website at:

[1] TECH Clean California, "Heat Pump HVAC Retrofit Cost Drivers", p. 19-20.

https://techcleanca.com/documents/2641/Heat_Pump_HVAC_Retrofit_Cost_Drivers_v4W3bW0_kiFU8k4.pdf

## Technical Section: Building local workforces

The first strategic pillar of the TECH program is to "Spur the clean heating market through statewide incentives, training, and consumer engagement". In order to do this, the TECH Clean California oversees a rigorous outreach campaign focused on contractor enrollment, workforce education, and market engagement, and supports contractors through training, assists with enrollments and applications, and disseminates information on new incentive opportunities.

TECH Clean California currently provides a variety of residential energy contractor trainings on heat pumps and heat pump water heaters (HPWHs) via classroom, live webinar, and on-demand trainings. TECH Clean California also partners with distributors, manufacturers, and the DOE to provide heat pump trainings through existing channels. Additionally, TECH Clean California provides hands-on experience via HPWHs distributed to contractors through our "Learn and Earn" program, and donations of heat pumps to colleges and trade schools. These include contractor trainings from Frontier Energy, Association for Energy Affordability, the ENERGY STAR HPHW ESMAC, and the National Comfort Institute; as well as EnergyCodeAce Trainings, utility-sponsored training, ACCA trainings. TECH offers free HPWHs to participating contractor firms who complete training in its "Learn and Earn" program. Participants are required to take the ESMAC training and a HPWH manufacturer installer training to obtain this free unit. Alongside heat pump equipment donations to training centers, TECH is partnering with lead heat pump manufacturers to facilitate faculty "Train the Trainer" events to incorporate heat pump technologies into the curriculum of statewide HVAC and plumbing programs. These faculty "train-the-trainers" events allow faculty to educate the incoming workforce and offer instructions for participants to impart their newfound knowledge onto local workforces.

On September 25, 2023, the TECH Clean California Team submitted comments to the CEC's RFI on Inflation Reduction Act Contractor Training Program. Those comments covered background on all of TECH's contractor training initiatives, as well as recommendations in response to various aspects of the IRA contractor training program. The overarching recommendations that TECH made related to best practices in contractor training and workforce development were:

- **Distinguishing Between Contractors, Service Technicians, and Installers:** There are many professionals that will require training [to meet heat pump deployment and building decarbonization goals], and multiple different existing pathways through which workers can be trained and certified. For example, while licensing is applicable to contractors, contractors employ service technicians and installers with different scopes, different requirements, and different training opportunities. The TECH team encourages the Commission to prioritize investment into contractor trainings that are not solely "contractor" level but that develop the skills of the technicians and installers that they employ.

- **Leveraging Existing Channels:** There are a multitude of existing pathways through which different contractors, installers, and service technicians might receive education on various aspects surrounding heat pumps. Rather than creating new training frameworks, the TECH team encourages the Commission to leverage existing training channels and efforts to minimize market confusion and duplication of work.

The TECH team encourages the Commission to revisit comments submitted to that docket log, Docket 23-DECARB-01, to support the Building Energy Action Plan.

Additionally, the TECH team encourages the Commission to consider innovative educational learning models that are being developed and researched around the country – such as those included in the U.S. Department of Energy's "National Blueprint for the Building Sector": Decarbonizing the U.S. Economy by 2050: A National Blueprint for the Buildings Sector | Department of Energy. We also encourage the Commission to integrate, amplify, and invest in strategies to engage underrepresented populations through workforce development initiatives – such as those cited by CARB in the "Equitable Building Decarbonization: Implementation Approaches" found at Equitable Building Decarbonization: Implementation Approaches | California Air Resources Board.

## Technical Section: Zonal decarbonization

The TECH team does not have specific data on zonal electrification opportunities or cost impacts but is in support of further research to understand how zonal electrification and grid infrastructure challenges layered onto energy consumption data could create a much more targeted and rigorous approach to strategic decarbonization statewide. TECH is focused on identifying long-term pathways to sustainably fund heat pump deployment at a scale to meet the state's ambitious goals. This requires identifying where heat pumps and electrification should be strategically deployed to optimize benefits. This will and should evolve over time to include, for example, understanding grid capacity constraints could help us target peak demand reductions, or similarly deploy approaches that do not build load in those areas. The TECH team looks forward to collaborating on this approach with the Commission in the future.

## Technical Section: Residential panel optimization and upsizing

As previously mentioned, in October 2023, the TECH Clean California program published a report - "Heat Pump HVAC Retrofit Cost Drivers: Impact of project and site features on the total installed cost of heat pump space heating retrofit projects in California single family homes". This report includes data reporting on the cost drivers for the early stages of the TECH Clean California heat pump market transformation program. The data presented in that report includes data on the "Average Impact on Total Project Cost of a three-ton Heat Pump HVAC installation" of an electric panel upgrade. The report

found that "on average, performing an electrical panel upgrade alongside a heat pump HVAC retrofit increases total project cost by approximately $1,500".[2]

The TECH Clean California program anticipates releasing a similar study for HPWH as well.

## Technical Section: Heat pump alterations and additions to existing buildings

The TECH team encourages the CEC to consider on-going data collection from the TECH Clean California program, which can be found on the TECH Reporting Site at: TECH Public Reporting Results and Reporting (techcleanca.com). This website hosts many resources on costs and installation barriers for heat pumps, including data from the TECH incentive program. For example, TECH's evaluator, Opinion Dynamics, published in February 2024 a "TECH Clean California Incremental Cost Study - Final Phase I Findings" report. That report can be found here: TECH Public Reporting Evaluation Studies (techcleanca.com)

## Technical Section: Data standardization and sharing

TECH Clean California provides many examples of using data from programs, including interval meter data, to track outcomes on heat pump cost-effectiveness, bill impacts, and other measures, as well as sharing the data publicly through the TECH Data Reporting platform. The TECH Implementation Team gathers multiple kinds of data and uses it both to guide program implementation and to provide public data reporting. All public TECH Clean California data is available on our public reporting website, www.TECHCleanCA.com. This website is intended to make detailed, empirical data available to accelerate market transformation of heat pumps. Data collection, analysis, and reporting plays a significant role in the TECH Clean California market transformation strategy. The TECH Implementation Team publishes data on installation details and energy impacts for as many TECH-incented projects as possible, as well as projects incented by other heat pump market deployment initiatives that share data with TECH such as the Bay Area Regional Energy Network (BayREN) and the SGIP HPWH program.

Data collection and reporting are critical to improve implementation strategy – especially given TECH's embedded evaluation approach, enabling the TECH Implementation Team to communicate in real time with the Program Evaluator. Public data reporting also catalyzes market transformation in and of itself: publishing data on large numbers of residential decarbonization projects will make outcomes and value streams more predictable, increasing competition and engaging more market actors, begetting more market growth and maturation. In gathering best practices for sharing program and/or energy data, the TECH team offers the following comments, consistent with many comments the team submitted in November 2022 to the CPUC's R.22-11-013 "Order Instituting Rulemaking to Consider Distributed

[2] TECH Clean California, "Heat Pump HVAC Retrofit Cost Drivers", p. 24-25.

Energy Resource Program Cost-Effectiveness Issues, Data Access and Use, and Equipment Performance Standards".

**Barriers for use of energy consumption data:** The TECH Implementation team has encountered two specific barriers preventing us from using energy consumption data to its full potential: a lack of clear and updated guidelines for Program Implementers to publish energy consumption data-based impacts for program participants, and an inability to share both gas and electricity consumption data with gas- and electric-only utilities. The TECH Team has commented to the CPUC on the benefit of additional guidance and clarification on opportunities to address these challenges from the appropriate governing regulatory authority.

**Additional data collection to support equity:** The data that the TECH Implementation Team has access to comprises residential customer electricity and gas meter-based consumption data as well as associated metadata describing each meter and service account in the database. This metadata includes rate codes and a label denoting if a customer is in a low-income program such as the California Alternate Rates for Energy ("CARE") program. This data is extremely useful for a program implementer or utility to perform broad customer targeting seeking out particular desired energy impacts, such as maximized positive bill impacts, minimized negative bill impacts, or maximized peak period electricity demand reduction. However, additional data fields would be useful to further improve users' ability to identify specific equity customers who might benefit most and prescribe specific interventions to help them participate in DER and/or building decarbonization programs. One set of data that could be merged with the existing electricity and gas meter data set is data describing the conditions of the electricity and gas distribution infrastructure surrounding each home, so program implementers and utilities could better plan the cost and feasibility of building decarbonization projects in low-income communities if data on grid conditions were available in conjunction with electricity and gas meter data. A second set of data that could be merged with the existing electricity and gas meter data set is data describing features of individual homes and their occupants that is related to equity. These data fields include the building vintage, the year of the last electrical panel upgrade, the primary language spoken in the home, the owner/renter status of the home occupants, and the household income. The building vintage and year of last electrical panel upgrade are highly correlated with the total installation cost for heat pump HVAC and HPWH equipment. Meanwhile, the primary language spoken in the home, owner/renter status, and household income are useful in determining a household's status as a Hard-to-Reach Community and Environmental and Social Justice ("ESJ") Community.

Thank you for the opportunity to comment.

Sincerely,

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