TECH CLEAN CALIFORNIA

Streamlining Permitting and Installation of Heat Pump Water Heaters

Final Pilot Report

May 14, 2024

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Executive Summary

The TECH Clean California Streamlining Permitting Pilot team is part of an ongoing effort to identify and overcome the barriers to widespread residential heat pump water heater adoption in California, focusing on inefficient or otherwise excessively burdensome permitting practices for heat pump water heater compared to permitting practices for traditional water heater replacements. The Pilot Team first established three baseline resources that can be used by building departments and installers alike as a best practices reference for heat pump water heater permitting. To help support adoption of these resources, the team conducted both quantitative and qualitative research on existing permitting practices and analyzed the data.

The pilot team determined that while the statewide average time to heat pump water heater permit issuance is 5.9 days, permitting timelines and challenges vary widely by jurisdiction. Specific to the incremental challenge of permitting a heat pump water heater rather than a gas-to-gas water heater change out, the most common permitting barriers faced were a lack of technical knowledge about heat pump water heaters by building department staff, the lack of a standardized permitting process across jurisdictions, and the difficulties that contractors face when managing differing permitting rules and guidelines. Written resources distributed by the team were useful as reference tools, but not sufficient in altering heat pump water heater permitting to be more efficient and code compliant. Online training sessions were more effective at developing knowledge, but significant learning gaps remain. The analysis suggests that providing direct experiential learning opportunities tailored to address the specific knowledge gaps of local building and permitting departments will be an important initiative in the development and implementation of a streamlined, single day permitting process for heat pump water heaters.

Important next steps include the design and widespread implementation of these experiential learning programs, and direct support for select jurisdictional partners during the first 10–20 heat pump water heaters permitted within their jurisdictions.

Pilot Description

Market Barrier and Proposed Solution

As described in the TECH Clean California "Streamlining Permitting and Installation of Heat Pump Water Heaters Pilot Implementation Plan," finalized October 7, 2021, heat pump water heaters currently have low market adoption in California. According to the 2019 California Residential Appliance Saturation Study, 65 percent of California households have gas-fueled water heating, while 9 percent have electric water heating.[1] Of that nine percent, heat pump usage for water heating is estimated at 1.25 to 1.5 percent[2] serving an estimated 15,000 to 18,000 residences, out California's more than 13 million households.[3]

Heat pump water heater installations also typically encounter extended permitting timelines, particularly in comparison to traditional gas water heaters. Building departments commonly allow "like-for-like" replacements of natural gas water heaters to be permitted over the counter on the same day. Conversely, for heat pump water heater installations, building departments sometimes require complex and multiday application processing that may deter homeowners and installers alike from making the switch from natural gas to heat pump water heaters and drive up the cost of installations. Prior to completing this pilot, these requirements were believed to exist primarily to ensure the increased energy load and electrical and wiring requirements could be safely met.[4] As the pilot findings indicate below, delays exist for a variety of reasons, not just electrical load requirements. In emergency replacement scenarios, longer install periods due to permitting holdups are a significant barrier preventing customers from making the switch from natural gas water heaters to heat pump water heaters.

This pilot originally aimed to help close the permitting time gap between gas water heaters and heat pump water heaters by adopting a single-day heat pump water heater permitting process within single family homes where code compliance could be simply and effectively demonstrated, such as when electrical or other physical upgrades are not required to complete installation. To accomplish this, the pilot intended to partner with a city or county building department to adopt and implement a model permit process. However, as described under "Pilot Approach and Evolution," the partner city activity was limited, and the team shifted its resources toward analyzing heat pump water heater permit data from jurisdictions across California to better understand current permitting practices statewide and regionally.

The pilot developed curriculum materials focused on educating permitting offices on heat pump water heaters to reduce the chance of permit delays and denials. Finally, this pilot was able to successfully collaborate as planned with Bay Area program administrators including the Bay Area Regional Energy Network (BayREN) Codes and Standards program to support training and sharing of best practices to promote heat pump installations for space heating and other end uses, e.g., heat pump dryers.

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1 DNV GL Energy Insights USA, Inc. 2020. 2019 California Residential Appliance Saturation Study. California Energy Commission. Publication Number: CEC-200-2021-005-ES. p. 12. Figure ES-6.

2 The TECH Clean California Market Study sites interviews with heat pump water heater manufacturers who note that "For water heating, heat pump usage is currently around 1.25–1.5 percent."

3 According to the U.S. Census Bureau's American Community Survey, the average number of households in California between 2017–2021 was 13,217,586.

4 2019 California Plumbing Code and the 2019 California Energy Efficiency Standards

Pilot Approach and Evolution

TECH Clean California hosted a series of meetings with stakeholders and working groups during the period of its initial launch in September 2021 through March 2022. In these meetings, the pilot received feedback on prioritizing resources with open discussions across stakeholders.

To increase building department staff understanding of best practices for heat pump water heater installation, the team developed a permitting packet consisting of a heat pump water heater Permit Guide, heat pump water heater Supplemental Permit Template, and an Electrical Load Estimator. Both BayREN and the broader TECH Clean California team promoted these resources to local contractors, homeowners, and building departments by making them available for download from BayREN and TECH Clean California websites. The teams required users to enter an email address to access the resources, which enabled the pilot to report the types of users requesting the information.

The pilot also worked in collaboration with BayREN Codes and Standards program to provide training on best practices to promote heat pump water heater installations beginning in January 2022. The permitting resources have been distributed and promoted through these trainings since May 2022. With ongoing feedback from stakeholders and building departments, the heat pump water heater permitting resources have been updated and continue to be distributed through additional websites and subsequent training.

To accomplish the goal of a streamlined permit process for heat pump water heater conversions, the pilot partnered with the city of pleasant hill building department to adopt and implement a model permit process and report on the effectiveness of the most promising strategies identified. Unfortunately, very little progress was made in the pilot partnership with the City of Pleasant Hill as there was just one heat pump water heater installation and permit issued during all of 2022, the year of the partnership.

Beginning in April 2023, the pilot shifted its focus from working with a single jurisdiction, to working with recently available TECH Clean California data from jurisdictions statewide. The team began collecting qualitative data by contacting jurisdictions throughout the State of California, identifying jurisdictions with heat pump water heater installations, and understanding their permitting process. The team reviewed data for 1,629 heat pump water heater projects that applied for TECH Clean California incentives, verified permits for 920 of those projects, and performed a quantitative data review of those permits. (It should be noted that there is anecdotal evidence from contractors that heat pump water heaters are often installed without permits.) These efforts resulted in the Heat Pump Water Heater Permit Data Analysis report, which documents the team's understanding of how the permitting timelines differ between jurisdictions and potential barriers to streamlined permitting.

The following dates reflect key program milestones or activity periods:

- Educational materials and outreach to jurisdictions: January 2022. Ongoing as of October 2023
- Quantitative permit data analysis: performed on projects that applied for a TECH Clean California heat pump water heater incentive between December 2021 through February 2023.
- Qualitative interviews: 100 jurisdictions were contacted and 36 jurisdictions provided email or phone responses, with initial outreach between April 2023 and June 2023, and additional follow-ups with 17 jurisdictions in September and October 2023.

Pilot Achievements and Findings

Achievement of Key Performance Indicators

The pilot had two main goals, each with separate key performance indicator (KPI) metrics: to facilitate adoption of a single-day permitting process for heat pump water heater, and to increase building department staff understanding of heat pump water heater installation best practices. Although the team shifted its approach to its first goal, it was able to identify 14 jurisdictions in California with a single-day average permit issuance timeline, and to identify that 42 percent of jurisdictions issue permits to 75 percent or more of their heat pump water heater permit projects in one day or less. The team was also able to identify a clear list of barriers to establishing single-day permitting, as noted below under the Goal 1 description. For the second goal, the team developed three heat pump water heater resources that can be used as a model for best practices for permitting a heat pump water heater, and conducted successful trainings that reached 69 jurisdictions. The team also developed a list of recommendations to further building department staff knowledge.

Table 1: Key Performance Metrics for TECH Clean California Streamlining Permitting Pilot

Goal 1: Facilitate adoption of heat pump water heater process that enables single-day permitting.

Metric	Data source	Changed, removed, or added since original pilot implementation program?
Administration having jurisdiction (AHJ) with streamlined permit process: 14 jurisdictions with data representing an application to issue time of 1 day or less*	Survey of participating AHJs	Original
Permit issuance time: 5.9 days average statewide 3.3 days from application to approval, 2.6 days from approval to permit issued 49% of jurisdictions issue permits to 75% or more of their heat pump water heater permit projects in 1 day or less 527 of the 774 permits verified for claims were issued in 1 day or less	Survey of participating AHJs	Original
Number heat pump water heater projects statewide receiving TECH Clean California incentives: December 2021 – April 2023: 1,692 December 2021 – February 2023: 774	TECH Clean California project data; Jurisdiction permitting data	Updated metric descriptions to clarify data source and timeframe Previous metrics: "Number heat pump water heater projects" and "Number of Heat pump water heaters permitted receiving TECH Clean California aligned

***The sample data is limited. Only four of these jurisdictions had a sample size greater than five permits to assess over a 15-month period.*

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Goal 2: Increase building department staff understanding of best practices for heat pump water heater installation.

Metric	Data source	Changed, removed, or added since original pilot implementation program?
Number of training curriculums influenced: 3	BayREN Codes & Standards Program	Original
Number of associated trainings delivered: 11	BayREN Codes & Standards Program	Updated
Number of participants: 278	BayREN Codes & Standards Program	Updated
Number of participating jurisdictions represented in trainings: 69	BayREN Codes & Standards Program	Updated from "Number of participating jurisdictions"
Number of downloads of resources from websites: 192	Websites: bayren.org techcleanca.com	New
Number of resources delivered during jurisdictional outreach: 17	Pilot team observations	New

Goal 1: Facilitate adoption of heat pump water heater process that enables single-day permitting

The initial tactic to achieve this goal was straightforward: the pilot intended to partner with a Bay Area jurisdiction to implement a single-day permitting process, and identify recommendations for other jurisdictions. However, this original tactic was not effective. Although the City of Pleasant Hill was confirmed as a partner and actively cooperated with the team, the pilot did not anticipate extremely limited market adoption of heat pump water heaters. During the partnership period, only one heat pump water heater project was submitted to the partner jurisdiction. Due to this limited market adoption, the pilot was unable to effectively launch and test a single-day permitting process.

This revealed a gap in data about the existing heat pump water heater market landscape, and thus the permitting landscape. To close this gap, the pilot shifted its efforts away from implementing a single-day permitting process at one jurisdiction, and instead toward understanding the current heat pump water heater permitting landscape in California, documenting findings in the *Heat Pump Water Heater Permit Data Analysis* report. The team conducted quantitative research, involving manually researching permitting records for 1,692 TECH Clean California projects with heat pump water heater incentives, resulting in 774 projects with permits verified, and analyzing the resulting data. The team found that of the 51 jurisdictions with verified heat pump water heater-permitted projects in the TECH Clean California incentive program during the period examined, 16 jurisdictions have a single-day permit process. Of those 16 jurisdictions, only four jurisdictions had more than five projects during the 15-month period

of data reviewed. The research found a statewide average timeline of 5.9 days from the time of permit application to permit issued.

However, average permit issuance timeline only tells part of the story; the analysis shows that 25 out of 51 jurisdictions, or 49 percent of jurisdictions, issue 75 percent or more of their heat pump water heater permits in one day or less. Although the team could not confirm this for each jurisdiction, qualitative interviews indicate that some jurisdictions with a single-day permit process achieve fast turnaround times by issuing heat pump water heater permits through the same permit process for electric resistance water heater units or gas water heaters, and thus may not collect some of the additional information described in the heat pump water heater resources created developed by the TECH Clean California team.

The team also found discrepancies in how heat pump water heater permits are handled among jurisdictions. One hundred jurisdictions were contacted by phone and email about their experience with heat pump water heater permitting, and completed 36 informal survey responses, then collected the qualitative feedback into a compilation of themes identifying permitting barriers. The barriers are described in the *TECH Clean California Pilot: Heat Pump Water Heater Permit Data Analysis* report and include some general or systemic barriers in the building permitting process, such as limited staff resources. However, barriers to single-day heat pump water heater permitting include:

- Lack of permit staff expertise about heat pump water heaters
- For those jurisdictions that differentiated between heat pump water heater and traditional water heater permits, this opened avenues for delay:
  - Additional electrical load due to conversions from gas to electric water heaters
  - Differences in required supporting infrastructure between tank-based and tankless systems
  - Condensate requirements; Heat pump water heater liquid condensate is sometimes falsely equated with the acidic flue gas condensate produced by combustion water heaters.
- Perceived importance of safety and plan checks; this was highly variable by region, with some regions requiring full plan checks and others not
- Barriers originating with contractors, such as plumbers not holding required licenses or experience to complete required electrical upgrades

Finally, the team identified that some jurisdictions do not differentiate between permitting requirements for heat pump water heaters and traditional water heaters, and thus may not collect data or perform verification in line with the best practices outlined in the materials developed for this pilot.

The results of the qualitative and quantitative analysis were compiled into a *Heat Pump Water Heater Permit Data Analysi*s report. Although this report does not directly achieve the goal of implementing a single day permit process, the report's findings and recommendations can be used to facilitate more streamlined permit processes in the future. The report also provides recommendations to support the pilot's second goal, which is to increase building department staff understanding of best practices for heat pump water heater installation. The *Heat Pump Water Heater Data Analysis* report is included as an attachment to this report.

Goal 2: Increase building department staff understanding of best practices for heat pump water heater installation

Although the pilot achieved its goals for increasing building department staff understanding of best practices for heat pump water heater installation, significant work remains to be done. As a first step, the pilot established resources for installation. Then the team began outreach to distribute these resources, influencing three curricula, delivering training 11 times, and engaging 278 participants across 69 jurisdictions. The team also made the resources available for download, resulting in 126 downloads, and directly provided the resources to 17 jurisdictions based on their requests during research interviews.

However, the resources and training have only reached a subset of California's more than 400 administration having jursdictions with varying levels of effectiveness. For the 11 sessions conducted with BayREN, 43 percent of attendees completed a post-training survey. Ninety-eight percent of those respondents indicated that they agree or strongly agree that the training increased their knowledge, however, of the 17 research interview respondents who requested access to just the resources, only one jurisdiction reported staff familiarity with the materials when follow-up calls were completed in September and October 2023.

The pilot successfully created recommendations based on its research to continue increasing building department staff understanding of best practices. The *Heat Pump Water Heater Permit Data Analysis* report includes information on interview themes collected as part of interviews with 36 jurisdictions, and recommendations for increasing staff knowledge based on those findings.

Research Questions and Conclusions

Question:	**What are the necessary building department criteria for the successful permitting of a single-day heat pump water heater conversion project?**
Hypothesis:	Natural gas water heaters have a generalized, simple single-day permit process. If building departments isolate criteria for a heat pump water heater conversion, they can build a single-day permit process.
Conclusion:	The pilot found criteria for permitting a conversion project. However, the pilot also identified constraints discussed above and in the *Heat Pump Water Heater Permit Data Analysis* report that may hinder a single-day permit issuance.

As part of its initial effort, the team compiled three permitting resources that can be used to define best practices:

- A 2022 Heat Pump Water Heater Building Code Assistance Sheet, which provides an overview of the relevant code requirements.
- A Permit Supplement Template that can be used to fulfill the code requirements of a single line electric diagram and a site diagram, and to note if any additional code requirements were potentially triggered.
- An Electrical Load Estimator that can be used to fulfill the code requirements.

Combined, these resources can empower an installer to prepare all necessary paperwork in advance of filing the permit. These resources can also allow building departments to examine their review processes to identify either gaps or excessive requirements. If a permit is submitted with the above resources completed, and the project is otherwise straightforward, this can help facilitate a single-day permit issuance or at least dramatically reduce the back-and-forth process and time expended that is common to incomplete permit applications.

Implementation of a single-day permit issuance statewide will require adaptation in both the workforce and within administration having jurisdictions. During qualitative interviews, jurisdiction staff indicated that contractors often are not prepared at the time of permit submittal as exhibited by incomplete applications. Moreover, the process of preparing the necessary permit paperwork may identify additional work that must be completed on the home, such as an electrical panel upgrade, that cannot be completed by a plumber. Finally, qualitative interviews showed that AHJ staff are generally unfamiliar with heat pump water heaters and may benefit from training to efficiently review permit applications.

That said, there are opportunities to streamline many existing jurisdictional processes. Some jurisdictions with extended permit issuance timelines request information based on a misunderstanding of the technology. For example, the team encountered a jurisdiction that interpreted the condensate disposal requirements of heat pump water heaters to mirror gas water heater condensate disposal requirements, which can create an additional burden of requiring a drywell and pump. However, heat pump water heater condensate is different and can be safely drained to a planter or green area to the side of the home. Because heat pump water heaters are still relatively new to many AHJs, jurisdiction staff need time to investigate and understand how to effectively enforce code. As AHJs incorporate best practice resources, their processes can be streamlined to eliminate unnecessary requirements and expedite permit issuance.

There are also likely jurisdictions that can expect to extend their existing heat pump water heater permit approval process if they were to integrate some of the pilot developed resources. For example, the team encountered jurisdictions that did not differentiate between a heat pump water heater and an electric water heater. As the AHJ and its contractor base incorporate the heat pump water heater best practices resources, they might experience some initial delays as they adopt the process until efficiencies increase for all parties, and the AHJ would ultimately be able to provide more effective code enforcement for its stakeholders.

Question:	**How could a single-day permit affect market adoption of heat pump water heater?**
Hypothesis:	Building on best practices and criteria identified by building departments, operationalizing a single-day permit will allow for more heat pump water heater installations compared to jurisdictions that do not have a single-day process.
Conclusion:	The pilot hoped to discuss this research question as part of its analysis, but the research completed cannot comprehensively address this question. Unfortunately, the quantitative and qualitative data analyses did not provide sufficient data to demonstrate a clear connection between single-day permitting and market adoption rates. The pilot identified 14 jurisdictions with an average permit application to issue time of less than one day, but there is not enough data to clearly suggest that a single-day permit process fosters an increase in heat pump water heater installations. The current mean permit processing timeline statewide is 5.9 days from application to permit issued; however, there does not appear to be a correlation between the number of permits issued and the average processing time by jurisdiction. This may be due to a relatively limited sample size of only 774 verified permits statewide during the study period. While there is the potential that a larger data sample may reveal a stronger correlation, the team does not yet have reason to suggest that processing more permits necessarily leads to reduced processing time; nor is there clear data to suggest that a single-day permit process directly results in an increase of installations.

Heat pump water heaters are still relatively new to the California market. Although the existing technology-specific market data is not sufficient to identify a clear pattern, there may be interdependence between market adoption rates, permitting timelines, and workforce training. With additional workforce training and as building departments adopt training resources into their permitting process flow, market adoption can be expected to increase. As market adoption increases, workforce installers are more likely to sell the technology and building officials to become more efficient at processing permits.

Question:	**How can we proliferate best practices for heat pumps generally and for a streamlined single-day heat pump water heater permit process to Bay Area and other California city and county building departments?**
Hypothesis:	Using BayREN's infrastructure, Bay Area building department staff can be trained in best practices to operationalize a single-day permit process for heat pump water heaters.
Conclusion:	BayREN's infrastructure allowed the program to identify a highly cooperative partner agency in Pleasant Hill, as part of the pilot effort to operationalize a single-day permit process. Unfortunately, due to the low volume of permit activity in the partner agency's jurisdiction, the pilot could not fully operationalize a single-day process. Instead, the pilot pivoted to researching the existing landscape of heat pump water heater permitting statewide.

The pilot conducted qualitative and quantitative research to identify recommendations to proliferate best practices for heat pumps generally and for a streamlined single-day heat pump water heater permit process to building departments. These recommendations are documented in the *Heat Pump Water Heater Permit Data Analysis* report. The specific recommendations are also listed in this document under Recommendations, but include:

- Continuing the current TECH Clean California outreach by providing educational materials through formal and recognized channels, including ICC, CALBO, CEC, and Energy Code Ace, leveraging both state channels and professional organizations.
- Providing high-touch support to select building departments during the permitting of their first 10-20 heat pump water heater projects.
- Continuing targeted outreach to jurisdictions with a high volume of TECH Clean California heat pump water heater incentive claim submittals to identify best practices.

Question:	**What are the implications of the pilot for equitable heat pump water heater adoption?**

Incorrectly permitted heat pump water heaters have an outsized impact on low-income customers. Heat pump water heaters installed without proper ventilation will be less efficient, meaning that customers may not see promised savings on their energy bills. If proper checks are not done as part of the permitting process and there are safety issues, such as incorrect or incomplete electrical panel upgrades, customers may face a variety of potential issues. Having a contractor come back out to fix the panel may be prohibitively expensive for low-income customers; even if they are able to rely on a program that pays for these corrections, that still requires use of limited funds that could be used to install more heat pump water heaters. There may also be equity challenges within the building departments. The pilot found that some building departments tried to achieve a one-day permitting turnaround due to having a large workload and minimal resources and staff. This means that a quick permitting process does not necessarily correlate with a thorough and accurate permitting process, leading to the issues described above. Our findings also indicated that greater personal familiarity with heat pump water heaters led to building department officials having more confidence in completing all steps in the permitting process. However, due to the current high cost, workers in low-income jurisdictions are less likely to have the income to personally install a heat pump water heater and gain that familiarity. Future TECH Clean California projects could focus specifically on installation in low-income jurisdictions to identify their specific needs.

Publications and Resources

Public-facing deliverables are made available on the TECH Clean California website, including:

- Heat Pump Water Heater Permit Resources
- Heat Pump Water Heater Permit Supplement Template
- Electrical Load Estimator
- 2022 Heat Pump Water Heater Building Code Assistance Sheet
- Meeting materials for stakeholder group and working group meetings, including meeting notes, presentations and draft resources
- *Heat Pump Water Heater Permit Data Analysis* report

Key Learnings and Next Steps

Key Learnings

Identifying the struggles of building departments in permitting heat pump water heaters was the biggest success of the pilot project. The pilot identified three primary barriers to one-day, code compliant permitting.

The first was lack of knowledge around heat pump water heaters. Some jurisdictions' staff expressed that they had not heard of heat pump water heaters before, while others said that they had never permitted a heat pump water heater, though their permit records indicated otherwise. Overall, 28 percent of interviewed jurisdictions stated that they did not distinguish between heat pump water heaters and other water heaters. This can result in oversights of crucial safety steps, such as checking electrical panel upgrades, potential efficiency problems such as not ensuring the heat pump water heater has enough ventilation space or overcomplicating the permitting process by treating its condensate the same as corrosive flue gas condensate.

The team also discovered that there was no standardized permitting process across the state, which is potentially confusing for contractors who work in different jurisdictions. There are regional variations in barriers among jurisdictions, and training materials should be designed to fit the challenges faced in each jurisdiction.

Finally, the pilot found that heat pump water heater installation can trigger requirements for additional work that is likely to extend the permitting and project timeline. Building department staff noted that heat pump water heater installers are usually plumbers who do not have the electrical knowledge to complete an electrical panel upgrade for a heat pump water heater; this either requires the extra time and money of hiring a subcontractor, or results in an improperly installed and permitted heat pump water heater. Compounding this problem is some contractors' uncertainty on navigating the online permitting process — what is intended to speed up the process may actually slow it down if contractors are not comfortable with the software.

Comparing the pilot data and building department staff interviews revealed that just because a building department has a same-day or otherwise swift turnaround time for a permit, it does not mean that the building department should be a model for streamlining the permitting process. Understaffing or the desire to keep permits from being backlogged resulted in some jurisdictions skipping safety and efficiency checks.

The pilot achieved some notable success with offering heat pump water heater training at a regional level, with training attendees reporting an increase in knowledge. However, the pilot's efforts at dispersing written resources without an associated training session was not particularly successful, with few outreach respondents accepting the materials and even fewer indicating that they had used them per follow-up phone calls. However, these materials are a necessary first step and reference tool to inform comprehensive training sessions that can more effectively inform the target audience.

If the team were asked to restart this pilot program, the team would have prioritized analyzing heat pump water heater adoption across California before selecting a partner jurisdiction to help streamline

the permitting process. Staff at the City of Pleasant Hill were cooperative and happy to help, but they did not have the ability to increase adoption in their city by themselves. However, with the research data about heat pump water heater adoption rates and permitting barriers from qualitative interviews, the team would be better prepared to select a partner jurisdiction to craft a one-day, streamlined permitting process. In the future, additional outreach could be done to the jurisdictions that issue a significant percentage of their heat pump water heater permits in one day or less.

Table 2: Key Learnings for TECH Clean California Streamlining Permitting Pilot

Learning or Research Conclusion	Next steps and Recommendations
Lack of personal knowledge around heat pumps leads to more errors in the permitting process.	Basic education and training about heat pump water heaters and how they work will help increase building department competency in permitting heat pump water heaters. The research conducted on the most common mistakes made in permitting heat pump water heaters, such as being treated the same as electrical water heaters, can inform trainings. Jurisdictions with a higher volume of heat pump water heater installations can be studied to discover best practices. Heat pump water heater distributors or installers could use a sticker to affix educational information about heat pump water heater code and operational requirements on the body of the unit for inspector and customer reference.
Written resources are not sufficient on their own to educate building department staff on heat pump water heater permitting.	Alternate methods of education, such as live demonstrations, on demand webinars, or other engaging options are suggested when designing learning materials for building departments.
While this pilot focused on building department staff, understanding barriers contractors face is important to streamlining heat pump water heater permitting.	Follow-up outreach could focus on contractors and the barriers they face in being code compliant in heat pump water heater installation. Whether it is feasible for plumbers who install heat pump water heaters to build partnerships with electricians to handle electrical panel upgrades could also be explored. Contractor training could be explored, as well as creating a certification or recognition for contractors who complete installation training.
There is no standardized process across the state for heat pump water heater permitting.	Access to educational events should be made available across the state. Consider promoting technology platforms, such as those promoted for solar permitting as part of SB379, that enable express permitting options.

Taking Learnings to Scale

The findings indicate that there are still many knowledge gaps that building departments face in quickly permitting heat pump water heaters with full code compliance. The team discovered that written materials alone are not sufficient to rapidly cover these knowledge gaps. With the help of TECH Clean California, the team hopes to craft learning materials tailored to each jurisdiction's needs, provide support to jurisdictions for their first 10–20 heat pump water heater permits, offering individual guidance as jurisdictions establish their permitting process. The team can also explore express permitting options through technology platforms, mirroring the strategy of expediting solar permitting under SB379, as a potential option to streamline permitting while providing code education. Finally, the team proposes to ask installers or distributors to affix educational resources to the units for reference by building inspectors and customers.

The team also proposes to hold engaging hands-on trainings, such as "Learn and Earn" sessions across the state, where building departments receive a no-cost heat pump water heater installed in exchange for attending a live demonstration on heat pump water heater installation and the permitting process. The "Learn and Earn" sessions intend to bring contractors and building department staff together, allowing them to answer each other's questions about the permitting process and discover pain points on both sides. Based on the findings that building department staff with personal experience with heat pump water heaters were more confident in answering questions about them, the team hopes that scaling up "Learn and Earn" experiences across the state will serve to familiarize building department staff with this emerging technology. This training could be used as the basis for creating a level of contractor certification or recognition of contractor knowledge, demonstrating to customers and building inspectors that the contractor is trained in heat pump water heater installation. The training or other events could also be used to foster relationships between plumbing and electrical contractors, so they can partner to complete installations.

Providing high-level support and personalized training materials should help bolster building department knowledge of permitting during the rollout of "Learn and Earn" experiences. The biggest barriers to these plans are the cost and the potential reticence of some building departments, but the team anticipates that the personalized nature of the support for the first 10–20 projects, and the offering of a free heat pump water heater for a "Learn and Earn," along with related contractor and building department supports, will work to foster heat pump water heater adoption and streamline permitting.

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California's award-winning heat pump program, TECH Clean California, has allocated $80.2 million in funds for heat pump water heater installations, designed to help accelerate the market for heat pump technology across the state through incentives, workforce training, and consumer education to create a pathway for achieving California's targets of six million heat pumps by 2030 and carbon-free, climate-ready homes by 2045.

TECH Clean California is funded by California ratepayers and taxpayers and administered by Southern California Edison Company under the auspices of the California Public Utilities Commission.

The TECH Clean California team is led by Energy Solutions and partners with Ardenna Energy, Association of Energy Affordability, Building Decarbonization Coalition, Electrify My Home, Frontier Energy, National Comfort Institute, Energy Outlet, Recurve Analytics, The Ortiz Group, Tre' Laine Associates, and VEIC.

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