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VIA Docket No. 23-DECARB-03

California Energy Commission
Docket Unit, MS-4
Docket No. 23-DECARB-03
715 P Street
Sacramento, California 95814

Re: **Comments on Draft 2025 California Building Energy Action Plan**

Dear Commissioners and Staff:

We write on behalf of the Joint Committee on Energy and Environmental Policy, the Western States Council of Sheet, Metal, Air, Rail, and Transportation Workers, the California State Pipe Trades Council, and the California State Association of Electrical Workers (collectively, the “Coalition”) to comment on the Draft 2025 California Building Energy Action Plan (“2025 Action Plan”).¹

The Coalition greatly appreciates the Commission’s leadership in advancing a comprehensive plan to achieve energy savings and deeper decarbonization of existing buildings through energy efficiency, electrification, and complementary strategies. However, the plan’s failure to address workforce training and installation standards presents a significant barrier to achieving the State’s energy efficiency goals, particularly during peak demand periods when HVAC-related loads are highest.

Studies have consistently shown that a substantial share of HVAC systems are installed incorrectly, in part due to low training rates among installers, resulting in performance losses that can reduce system efficiency by 20 to 30 percent. These installation deficiencies can lead to increased peak energy use, undermining the intended grid and emissions benefits of efficiency investments. Similar challenges have been documented for advanced lighting controls, where

¹ California Energy Commission, Draft Commission Reprint: California Building Energy Action Plan (Dec. 2025) (hereinafter “2025 Action Plan”), *available at* <https://efiling.energy.ca.gov/GetDocument.aspx?tn=268342&DocumentContentId=105532>.

research has identified high rates of installation and commissioning failures that prevent controls from operating as designed. Without a sufficiently trained workforce to ensure proper installation and system integration, efficiency measures may fail to deliver expected energy savings in practice, limiting California's ability to meet its energy efficiency and peak load reduction targets.

Workforce standards are a key tool to meet the State's high road job and workforce development goals. The Commission appropriately recognizes that building decarbonization presents a significant opportunity to expand California's clean energy workforce. Realizing this opportunity will require strengthening and expanding the State's existing network of apprenticeship programs and other workforce development initiatives.

However, the plan lacks concrete commitments and policies to ensure the State's investments prioritize high road contractors and promote the creation of high road jobs. Without clear standards, public funding may fail to deliver the quality outcomes, workforce stability, and long-term economic and environmental benefit that California seeks. State policy makes clear that investing in a skilled and trained workforce should not be treated as a cost, but rather as a long-term investment. Strong workforce standards that incentivize contractors to train and retain their employees are essential tools to achieving the State's climate and clean energy goals.

The Coalition offers several clarifications and refinements to the 2025 Action Plan's issues and recommendations to strengthen implementation and ensure the plan achieves its intended outcomes. The Coalition wholeheartedly supports the Commission's efforts to ensure that California achieves its decarbonization goals. However, these goals must be achieved in a manner that promotes quality, accountability, and equitable workforce development.

I. STATEMENT OF INTEREST

The Joint Committee on Energy and Environmental Policy ("JCEEP") is an advocacy organization that represents the California sheet metal workers' local unions and over 25,000 technicians working for over 600 contractors throughout California. JCEEP's mission is to promote responsible environmental and indoor air quality and energy policy in California as it pertains to and impacts the HVAC industry.

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The Western States Council of Sheet Metal, Air, Rail, and Transportation Workers (“WSC SMART”) represents Sheet Metal Workers' Local Unions in California, Arizona, Nevada, and Hawaii. Its members install all types of HVAC systems, both residential and commercial, and are committed to not only ensuring indoor comfort through heating and cooling but also safeguarding air quality and promoting energy efficiency in HVAC systems. In California alone, the WSC SMART operates over 15 training facilities, where thousands of workers are trained daily in HVAC specialties, including heat pump installations.

The California State Pipe Trades Council (“CSPTC”) represents more than 30,000 union plumbing, pipefitting, and HVAC installers throughout California. The CSPTC and its local union members have long advocated for building standards and regulations to improve the health, safety and efficiency of buildings in California, and for meaningful enforcement of these standards to level the playing field for high road contractors that take compliance with permit, code and energy code compliance documentation requirements seriously. The CSPTC Apprentice Program invests over \$18 million annually to train the next generation of plumbers, pipe fitters, and refrigeration and air conditioning journeymen at 27 apprenticeship training centers across the state and to provide continuing education training opportunities to its existing members with a focus on new technologies such as heat pump water heating and HVAC equipment.

The California State Association of Electrical Workers (“CSAEW”) and its member IBEW locals represent approximately 83,000 active members in California that work in all aspects of electrical construction. CSAEW has long been an advocate for increased energy efficiency, renewable energy and anergy storage building requirements. CSAEW’s members operate over 25 apprentice training centers across the state. These centers provide the highest level of classroom and hands-on training available in code compliance, workmanship and safety to ensure that electricians have the skills, experience and abilities needed to meet California’s energy goals, including assessing the need for wiring or panel upgrades in existing buildings, installing complex lighting control systems, installing electrical vehicle charging systems, installing demand response systems, installing battery storage systems and installing solar photovoltaic systems.

These organizations and their members have long advocated for quality installation practices, code and permit compliance, and the development and implementation of education and training programs that advance safety, performance and efficiency in California’s building sector.

II. COMMENTS ON MAJOR ISSUES

A. Building Local Workforces

1. The Commission Should Revise the 2025 Action Plan’s Definition of High Road Jobs to Meet Relevant Prior Regulatory and Policy Definitions

The 2025 Action Plan’s definition of “high road jobs”² does not appear to be based on any published definition or established framework and misses a key foundational element: meaningful worker training and workforce development. This omission is inconsistent with longstanding California energy workforce policy. “High road jobs” were expressly identified as essential to achieving both equity and performance outcomes in energy efficiency programs in the 2014 ratepayer-funded guidance plan, *Workforce Issues and Energy Efficiency Programs: A Plan for California’s Utilities* (“Guidance Plan”), prepared by the University of California Berkeley, Donald Vial Center for Employment in the Green Economy.

The Guidance Plan found that the historic practice of investor-owned utilities (“IOUs”) rejecting workforce standards to maximize contractor participation created a structural disincentive for contractors to invest in worker training and retention. By failing to set workforce standards, IOUs effectively subsidized “low road” contractors who could undercut bids from high road contractors by avoiding investments in workforce quality.³ The Guidance Plan concluded that contractors who invest in training and retaining a skilled workforce consistently deliver higher quality services, safer work practices, and greater customer satisfaction.⁴ It therefore recommended that IOU energy efficiency incentive programs require the use of high-road contractors who employ skilled and trained workers in order to “ensure that ratepayer-subsidized [energy efficient] measures are properly installed, operated, and maintained, and that the energy savings potential from ratepayer subsidies is fully realized.”⁵

² 2025 Action Plan, p. 77, fn. 185, p. 157.

³ Donald Vial Center on Employment in the Green Economy, *Workforce Issues and Energy Efficiency Programs: A Plan for California’s Utilities* (2014) p. 51 (“Guidance Plan”), available at <https://laborcenter.berkeley.edu/pdf/2014/WET-Plan14.pdf>.

⁴ *Ibid.*

⁵ *Id.* at 2.

Similarly, the California Workforce Development Board’s *Putting California on the High Road: A Jobs and Climate Action Plan for 2030* (“High Road Report”) reinforces this framework by identifying three core principles that State policymakers should consider for climate policy implementation:⁶

- **Labor should be considered an investment rather than a cost.** Investments in growing, diversifying, and upskilling California’s workforce can positively affect returns on climate mitigation efforts. In other words, well trained workers are key to delivering emissions reductions and moving California closer to its climate targets.
- **Job quality direct equity.** California can achieve greater social equity when policymakers prioritize job quality – those that offer family-supporting wages, employer-provided benefits, worker voice, and opportunities for advancement – and then build pathways into those careers. Workforce education and training must meaningfully improve workers’ economic mobility.
- **Deliberate policy intervention is required.** Advancing job quality and social equity in the transition to a carbon neutral economy requires intentional policy design – just like reducing pollution and protecting public health does.

Taken together, these established policies make clear that workforce training and job quality are not optional features of “high road” employment – they are central to program effectiveness, equity, and climate performance. Accordingly, the definition of “high road jobs” should reflect this established policy consensus:

High road jobs are jobs that offer family-supporting wages, employer-provided benefits, worker voice, opportunities for advancement, and workforce education and training to help create a highly skilled and qualified workforce and to meaningfully improve workers’ economic mobility.

⁶ California Workforce Development Board, *Putting California on the High Road: A Jobs and Climate Action Plan for 2023* (June 2020) p. ii-iii (“High Road Report”), available at <https://cwdb.ca.gov/wp-content/uploads/sites/43/2020/09/AB-398-Report-Putting-California-on-the-High-Road-ADA-Final.pdf>.

Without explicitly incorporating workforce training and skill development, the definition falls short of California’s own adopted principles and risks undermining both climate performance and equity outcomes.

2. The Commission Should Correct Misconceptions About the Cost-Effectiveness of High Road Policies

The 2025 Action Plan erroneously claims that decarbonization projects may be less effective if contracts with high-road jobs, such as union labor or prevailing wage jobs, are part of program requirements.⁷ This assertion is incomplete and misleading because it focuses narrowly on the upfront labor costs while ignoring factors that directly affect overall program performance and long-term effectiveness.

Labor costs are only one component of total project cost, and higher-skilled, better-trained workforces often deliver higher-quality installations, fewer errors, and lower rework rates. In energy efficiency and building decarbonization programs, improper installation or poor workmanship can significantly reduce actual energy savings, shorten equipment life, and increase maintenance costs. When these lifecycle impacts are considered, higher standards for training, wages, and workforce qualifications can improve – not reduce – cost effectiveness.

Moreover, characterizing high-road labor requirements primarily as a “cost” is inconsistent with the policy framework established in the High Road Report.⁸ The report emphasizes that labor should be viewed as an investment in quality, reliability, and long-term program capacity, rather than as an expense to be minimized.⁹ A skilled and stable workforce is necessary to deliver sustained building retrofits, equipment installations, and maintenance required to meet statutory decarbonization targets.

To achieve greater social equity in labor market outcomes for disadvantaged workers and communities, policymakers must pay attention to job quality.¹⁰ Deliberate policy interventions are necessary to advance job quality and social equity as California transitions into a carbon neutral economy, just as such efforts

⁷ 2025 Action Plan at p. 83.

⁸ High Road Report at pp. ii, 7-8, 54.

⁹ *Ibid.*

¹⁰ *Id.* at p. ii.

are required to reduce pollution, protect human and environmental health, and to safeguard communities from an already changing climate.¹¹

Decarbonization programs are designed to produce multiple public benefits, including reliable emissions reductions, durable infrastructure, consumer protection, and workforce development. Evaluating cost effectiveness solely based on short-term labor costs, while disregarding installation quality, program durability, and workforce capacity, risks understating the true value of high-road standards and may lead to less effective outcomes over time.

3. The Commission Should Promote the Use of Workforce Standards

Workforce standards are a critical missing element in the 2025 Action Plan. Without clear expectations for training, certification, and utilization of skilled labor, public investments in decarbonization risk underperforming, experiencing delays, and failing to deliver long-term reliability. Workforce standards ensure that incentive dollars support contractors who adequately train their workers and consistently deploy a qualified workforce on complex energy and electrification projects. These standards protect both public funds and project outcomes.

Policies that increase demand for apprentices and apprenticeship graduates should be the default for any work supported by prevailing wage. Registered apprenticeships are the most reliable pipeline for developing skilled workers at scale, combining classroom instruction with supervised, hands-on experience. Requiring the use of apprentices and graduates helps ensure that projects are completed safely and correctly, while also expanding career pathways into family sustaining jobs and building a workforce capable of meeting long-term climate goals.

Incentive programs should also prioritize training partnerships run through local unions and building trades councils. These organizations already maintain extensive training infrastructure, including accredited training centers, experienced instructors, and established safety and quality standards. Supporting these programs is cost-effective because it builds on systems that already produce highly skilled workers, rather than attempting to create new training pipelines from scratch. In addition, union and joint labor-management programs have strong completion rates and clear accountability mechanisms, ensuring that public investments translate into measurable workforce outcomes.

¹¹ *Id.* at pp. iii.

Where there are concerns about having a large enough workforce, high-road contractors – those that invest in training, retaining skilled workers, and maintaining strong labor standards – should receive first priority for incentives and contracts. High-road employers are more likely to deliver projects on schedule, comply with wage and safety laws, and contribute to long-term workforce development rather than relying on temporary or undertrained labor.

At minimum, programs that remain open to low-road contractors should include meaningful workforce training requirements. For example, contractors could be required to provide documented, hands-on installation training specific to the products being installed, ensuring that workers understand proper techniques, safety procedures, and performance standards. Even modest but enforceable requirements can significantly improve project quality and worker safety while helping to prevent costly rework or equipment failure.

4. Short-Term Training Programs Are Not Sufficient to Ensure Quality Installation

The 2025 Action Plan claims that “[s]hort-term programs can teach underemployed construction workers new skills and help them obtain certification for HVAC retrofits and installing other equipment needed to meet California’s decarbonization goal.”¹² However, short-term equipment-focused training – such as manufacturer-led webinars on the installation of a specific technology – has not been demonstrated to ensure consistent installation quality, particularly for workers without prior experience in plumbing, mechanical, or electrical systems. These types of training courses are generally most effective for installers who already possess foundational knowledge of system design and installation practices.¹³

Retrofit installations in particular present highly variable conditions that differ substantially from standardized training scenarios. Most short-term courses do not require field experience or include hands-on or performance-based testing and therefore do not adequately prepare new entrants to address the system-level interactions to determine installation quality. Manufacturer-led training typically assumes an existing understanding of broader HVAC or plumbing systems. Without this foundation, there is limited assurance that equipment will be installed correctly or operate with the expected efficiency and performance. Comprehensive

¹² 2025 Action Plan at p. 81.

¹³ Guidance Plan at p. 51.

system training and field experience – such as that provided through state-approved apprenticeship programs – are necessary to equip workers to navigate real-world installation conditions and ensure that deployed technologies deliver expected efficiency and emissions reductions.

5. The Commission Should Promote Programs that Support High Road Contractors

The 2025 Action Plan identifies several programs that create meaningful opportunities to develop the building decarbonization workforce: the Building Initiative for Low-Emissions Development (BUILD) Program, the Technical Energy and Clean Heating (TECH) Program, the Equitable Building Decarbonization Direct Install (EBDDI) Program, and the California Training for Residential Energy Contractors (CA TREC) Program.¹⁴

Among these, the EBDDI Program and workforce training initiatives like CA TREC most clearly demonstrate how decarbonization investments can support high-road workforce outcomes while advancing climate goals. By prioritizing the use of registered apprentices and apprenticeship graduates, these programs help ensure that workers receive supervised training, earn industry-recognized credentials, and develop the technical skills necessary to perform complex installations safely and correctly. This approach strengthens installation quality, protects public and ratepayer investments, and improves long-term energy performance.

The EBDDI program integrates workforce development directly into program design. It provides priority access to contractors that meet multiple high-road criteria, including compliance with “skilled and trained workforce” standards, participation in state-approved apprenticeship programs, targeted local hiring strategies, and commitments to community workforce agreements.¹⁵ The program also establishes minimum training and experience requirements for construction workers and requires that at least one-third of workers on a project meet those standards.¹⁶ These provisions help ensure that publicly funded decarbonization projects deliver both climate and workforce benefits.

¹⁴ 2025 Action Plan at p. 82-83.

¹⁵ California Energy Commission, Equitable Building Decarbonization Direct Install Program Guidelines (Oct. 2023) p. 28-29, *available at* <https://efiling.energy.ca.gov/GetDocument.aspx?tn=252682&DocumentContentId=87762>.

¹⁶ *Id.* at p. 29.

Similarly, CA TREC invests directly in training infrastructure by supporting pre-apprenticeship, apprenticeship, and vocational programs by reducing financial barriers to certification.¹⁷ Nearly half of the \$10 million available will go to these programs to cover training and certification expenses for residential energy efficiency programs.¹⁸ However, reference to CA TREC in the 2025 Action Plan is misleading because the program is designed to support workforce education and training, but does not provide training directly itself. Moreover, support for a training program does not inherently ensure that the program itself provides all the training necessary to improve installation outcomes. CA TREC also does not increase demand for the use of trained and qualified technicians. It just helps facilitate access to such training.

The TECH program does not currently require the workforce standards typically associated with high-road employment, and the 2025 Action Plan's assertion that the program helps meet the local needs for a skilled and trained workforce is not supported by its design.¹⁹ The TECH program is focused primarily on contractor-facing heat pump sales and technology training and does not provide meaningful installer training, nor does it require participating contractors to provide training to their installation workforce. As a result, contractor participation in the program is not contingent upon demonstrated investments in workforce development or job quality.

However, the TECH program could be, and should be, revised to support, incentivize, and prioritize participation by high road contractors that provide meaningful training to their workers and create quality job opportunities to local residents, including through participation in state-approved apprenticeship programs. Absent such revisions, reliance on the TECH program alone is unlikely to improve workforce quality or support the creation of high road career pathways.

6. The Commission Should Support a Just Transition in Building Decarbonization

The 2025 Action Plan should consider the equity of building decarbonization on plumbing trades in program and technology planning decisions. As California advances policies to electrify building end uses, including space and water heating,

¹⁷ California Energy Commission, Grant Funding Opportunity: California Training for Residential Energy Contractors (CA-TREC), GFO-25-901 (Dec. 2025).

¹⁸ *Ibid.*

¹⁹ 2025 Action Plan at p. 83.

it is important to recognize that these transitions may significantly alter the scope and availability of work traditionally performed by plumbing professionals. Absent deliberate policymaking, decarbonization incentives may unintentionally contribute to workforce disruption by reducing demand for certain plumbing services without creating comparable high-road employment opportunities that leverage existing skill sets. Decarbonization solutions that create comparable employment opportunities and support skill transfer for plumbers, including continuity of work within state-approved apprenticeship pathways, should therefore be prioritized where feasible.

Incorporating workforce transition considerations into program design can help ensure that investments in building decarbonization also support job quality, workforce stability, and equitable access to career pathways in the clean energy economy. For example, thermal energy networks (“TENs”), which rely on significant piping infrastructure for the distribution of heating and cooling, may provide demand for plumbing-related skills and offer a viable pathway for maintain high-road employment opportunities within the plumbing trades. Incentivizing and encouraging the deployment of such systems in large campuses, neighborhood, or community developments, where shared thermal infrastructure can be integrated during early planning and design phases, may help align decarbonization objectives with workforce equity goals while minimizing potential trade displacement effects.

B. Code Compliance for Existing Building Retrofits

The 2025 Action Plan correctly recognizes that code compliance for existing building retrofits remains a significant barrier.²⁰ However, it fails to address a critical component of improving compliance: proper installation. Even the strongest codes cannot deliver the intended energy savings or safety benefits if installations are performed incorrectly.

Proper equipment installation is essential to achieving energy savings and greenhouse gas (“GHG”) reductions that energy efficiency and decarbonization policies are designed to deliver. Equipment efficiency depends not only on the equipment itself, but on the quality of installation, commissioning, and verification.

For example, a 2008 report prepared by the Energy Commisison found that poor-quality HVAC installation can increase energy use by 20% to 30%, effectively

²⁰ 2025 Action Plan at p. 113-18.

erasing much of the expected efficiency benefit.²¹ The report also found that as many as 85% of replacement HVAC systems are installed incorrectly and that contractors complied with Title 24 quality installation requirements only about 15% of the time.²²

The consequences of this noncompliance were significant. The 2008 report estimated that if permit and inspection requirements were consistently followed, California's peak electricity demand could be reduced by approximately 130 megawatts annually.²³ More recent analysis by the California Public Utilities Commission indicates that permits are now obtained for fewer than 8% of residential HVAC replacements, while the number of replacement projects has increased to roughly one million per year – nearly triple earlier estimates.²⁴ This suggests that improved compliance could yield on the order of 400 MW in peak demand savings.

These savings are especially important because HVAC systems consume the most energy during peak demand periods. In California, meeting peak demand often requires dispatching natural gas-fire powerplants, which are among the most expensive and carbon-intensive sources of electricity. Reducing peak demand through proper installation therefore provides disproportionate benefits, lowering system costs while avoiding the highest-emission generation.

The lack of permitting also distorts the marketplace. Contractors who perform unpermitted work can underbid responsible competitors by avoiding compliance costs, skipping commissioning and acceptance testing, and relying on low-wage or inadequately trained workers. When permits are not pulled, local building departments cannot enforce Title 24 standards, and responsible contractors are placed at a competitive disadvantage.

At the same time, permit compliance is not sufficient to guarantee high-quality outcomes. Even permitted projects sometimes fall short of code requirements, particularly when workforce training and accountability standards

²¹ California Energy Commission, Strategic Plan to Reduce the Energy Impact of Air Conditioners, CEC-400-2008-010 (June 2008) p. 5 (poor quality installation of cooling systems results in a 20-30 percent increase in energy use) (hereinafter “2008 HVAC Report”).

²² *Id.* at p. 5, 30-31.

²³ *Id.* at p. 31.

²⁴ See California Energy Commission, Request for Proposals: HVAC Equipment Installation Compliance Tracking System Business Needs and Functional Requirements, RFP-16-403 (Feb. 2017) at p. 10

are weak. For this reason, permit compliance strategies must be paired with workforce standards and documentation requirements that ensure systems are installed, tested, and commissioned correctly. Training requirements, certification standards, and verification protocols ensure that pulling permits leads to meaningful compliance rather than a purely administrative step.

However, without permits, none of these safeguards can be enforced. If a permit is not pulled, installation requirements, accepting testing, and performance verification cannot be required or verified. Without permit compliance, the Energy Commission's documentation requirements are effectively unenforceable, and estimates of energy savings based on equipment sales or program participation become unreliable. Ensuring consistent permitting combined with strong workforce and compliance standards, is therefore essential to delivering the real-world energy savings and emissions reductions that California's policies are intended to achieve.

Lastly, the 2025 Action Report's summary of the 2014-2016 HVAC Permit and Code Compliance Market Assessment Report when discussing rates of permit and code compliance is somewhat misleading because it leaves out important findings and clarifications.²⁵ Most notably, the summary ignores the report's findings that permit compliance alone is not enough to achieve meaningful energy efficiency outcomes. Compliance must be paired with installer training requirements and stronger building department enforcement to ensure that permitted work is installed correctly and performed as intended.

The summary also fails to acknowledge other relevant research estimating the prevalence of poor installation rates and their measurable impact on system efficiency. In particular, the discussion regarding rates of permit and code compliance should be supplemented with reference to the findings made in the 2008 report, which documents how proper installation can significantly undermine expected energy savings.²⁶

C. Health Benefits of Building Decarbonization

The 2025 Action Plan correctly recognizes that building decarbonization can improve air quality and public health by eliminating emissions from indoor fossil fuel combustion.²⁷ However, realizing these benefits in practice depends on

²⁵ 2025 Action Plan at p. 114.

²⁶ 2008 HVAC Report at p. 5, 31.

²⁷ 2025 Action Plan at pp. 43-47.

ensuring that replacement equipment is installed properly. Decarbonization projects may fall short of expected health, safety, and energy outcomes without proper installation, commissioning and verification.

Improper HVAC installation and faulty duct work can directly harm indoor air quality. Poorly sealed or improperly configured ducts can draw contaminants from attics, crawlspaces, and wall cavities into living areas, exposing occupants to pollutants such as carbon monoxide, mold spores, dust, and rodent waste. Inadequate airflow and filtration can further concentrate indoor pollutants, increasing the risk for respiratory illness, asthma exacerbation, and other health impacts. Proper installation, sealing, and commissioning of duct systems are therefore essential not only for efficiency but for maintaining safe and healthy indoor air environments.

Improper water heater installation presents additional safety and health risks. All water heaters, if poorly installed, can leak and cause extensive property damage, which in turn can lead to mold growth and long-term indoor air quality problems. Gas-fired water heaters carry risks of gas leaks, fires, explosions, and carbon monoxide exposure when venting or connections are not installed correctly. Heat pump water heaters, while safer in many respects, still require proper installation to prevent refrigerant leaks, drainage failures, or electrical hazards. In addition, replacing gas appliances with electrical equipment can increase electrical loads. If panels, wiring, and circuit protection are not properly evaluated and upgraded where necessary, the risk of overheating and electrical fires increases.

Installation quality also has important environmental justice implications. Poorly installed HVAC and water heating systems increase overall energy use and raise electricity demand during peak periods. In California, peak demand is often met by dispatching natural gas-fired power plants, many of which are in or near disadvantaged communities that already experience disproportionate exposure to air pollution. Increasing energy savings, especially during peak periods, can reduce the need to operate these plants, directly lowering emissions in the most affected communities.

Permit compliance plays a critical role in addressing these risks because it triggers inspections, ensures adherence to building and energy codes, and provides a mechanism to verify that installations meet safety and performance standards. However, permits alone are not enough. Achieving the full health and safety benefits of decarbonization requires aligning permit compliance with workforce

training standards, acceptance testing, and accountability measures that ensure installations are performed correctly the first time.

D. Refrigerant Use, Recovery, and Reclamation

Refrigerant use, recovery, and reclamation are critical components of building decarbonization.²⁸ As California transitions to heat pumps and other electrified technologies, the quantity of refrigerants in residential and commercial buildings is expected to increase.²⁹ Many low-global warming potential refrigerants are mildly flammable. Adequate installer training is thus essential to prevent leaks and protect worker and occupant safety, in addition to ensuring that anticipated GHG reductions are achieved.

The 2025 Action Plan correctly recognizes that “[t]raining, certification, and licensing are key to a technician’s ability to handle refrigerants properly.”³⁰ Technicians who handle refrigerants are required to obtain a U.S. EPA 608 certificate, but this certification does not require periodic renewal or demonstration of continuing practical competency.³¹ In addition, California does not establish minimum standards for technicians, although contractors performing this work must hold the appropriate contractor license, such as a C-20 (Warm-Air Heating, Ventilation and Air Conditioning) license or C-38 (Refrigeration) license.³²

The 2025 Action Plan highlights an important issue that arises frequently in program implementation: the distinction between a technician and a contractor.³³ The technician is typically an employee or individual who performs installation, maintenance, or repair tasks under the supervision of a licensed contractor or company, and may hold trade-specific certifications or training credentials but does not independently contract for work. It is critical that the technicians possess the necessary training and experience to safely handle refrigerants.

In contrast, a contractor holds a state-issued contractor’s license that authorizes them to bid for projects, enter into contracts, hire and supervise workers,

²⁸ 2025 Action Plan at p. 131-35.

²⁹ *Id.* at p. 133-34.

³⁰ *Id.* at p. 132.

³¹ *Ibid.*

³² *Ibid.*

³³ *Ibid.* (“The California State Licensing Board requires *technicians* to maintain a C-20 Warm-Air Heating, Ventilation and Air Conditioning Contractor license or C-38 Refrigeration Contractor license. However, companies need only one license that covers all employees.”) (emphasis added).

and assume legal and financial responsibility for the work performed. Licensed contractors must meet related experience, examinations, bonding, and insurance, and are accountable for compliance with applicable building codes, safety standards, and labor laws.

The 2025 Action Plan recommends requiring proof of practical refrigerant-recovery skills to complement the 608 certifications, along with stronger on-site enforcement and meaningful penalties for noncompliance.³⁴ To improve safety, installation quality, and the likelihood that projected GHG reductions are realized, the Commission should recommend requiring that refrigerant recovery and related work be performed by workers who have completed, or are enrolled in, a state-approved apprenticeship program or who hold an equivalent journey-level qualification.

Apprenticeship and journey-level training is preferable because they provide structured, supervised, and hands-on instruction in piping practices, brazing, pressure testing, system evacuation, and leak prevention – skills that are critical to safe refrigerant handling but are not fully addressed through examination-based certification alone. These programs also include training in safety standards, mechanical codes, and proper use of recovery equipment, and they establish clear pathways for oversight and accountability. Requiring these qualifications would help ensure a skilled workforce, reduce the risk of leaks and safety incidents, and better align program implementation with the state’s decarbonization and emission-reduction goals.

E. Residential Panel Optimization and Sizing

Electric panel optimization strategies can play an important role in avoiding unnecessary panel upgrade costs and enabling near-term building electrification.³⁵ However, these solutions are highly project-specific and require qualified technical review to ensure safe implementation and accurate assessment of available electrical capacity. At a minimum, proposed optimization strategies should be reviewed and approved by certified general electricians or licensed electrical engineers.

In addition, such evaluations should account for anticipated future electrical loads to ensure that panel optimization measures do not limit a building’s ability to

³⁴ *Id.* at pp. 132, 135.

³⁵ *Id.* at pp. 84-88.

accommodate electric vehicle charging infrastructure. Optimizing panel capacity to support building electrification without preserving sufficient capacity for electric vehicle charging may result in costly future upgrades, creating financial barriers for occupants seeking to transition from gas-powered to electric vehicles. For low-income homeowners or renters, these deferred upgrade costs may effectively eliminate the opportunity to adopt electric vehicles, undermining the State's transportation electrification and equity goals.

III. COMMENTS ON RECOMMENDATIONS

The 2025 Action Plan provides 14 recommendations intended to guide overall policy direction for building decarbonization efforts.³⁶ The Coalition generally supports the recommendations and appreciates the Commission's efforts to advance a comprehensive strategy for building decarbonization. The 2025 Action Plan represents meaningful progress and identifies several policy approaches that, if implemented effectively, could accelerate emissions reductions, improve energy performance, and expand market participation. At the same time, the Coalition offers several clarifications and refinements to strengthen implementation and ensure that the recommendations achieve their intended outcomes.

First, while we support continued prioritization of funding for incentives,³⁷ those investments should be explicitly tied to high-road workforce standards. Incentive programs should require the use of adequately trained and credentialed workers and incorporate strong labor standards where appropriate. Without clear workforce requirements, the state risks uneven installation quality, poor equipment performance, and missed economic development opportunities. Aligning incentive funding with training, certification, and job quality standards will improve project outcomes and ensure public investments generate long-term value.

Second, although we strongly support maintaining a focus on equity,³⁸ the framework should more clearly incorporate equity for workers alongside equity for consumers. Policies designed to reduce energy burden and expand access to clean energy must also ensure fair wages, safe working conditions, and accessible career pathways for workers from underserved communities. A comprehensive equity strategy should address both who benefits from programs and who delivers them.

³⁶ *Id.* at pp. 12-15.

³⁷ 2025 Action Plan at p. 12.

³⁸ *Ibid.*

In addition, equity of the impacts of decarbonization on plumbers should also be considered. Plumbers are being asked to disproportionately bear the burden of decarbonization efforts. Historically, gas plumbing represented approximately 20 percent of the plumbing hours in new construction. This is work that electrification efforts are eliminating. Decarbonization solutions that help create replacement jobs for plumbers should be prioritized. For example, TENs should be incentivized and encouraged in large campuses or new neighborhood or community projects.

Third, in prioritizing energy efficiency investments for affordability, programs should also include robust quality assurance and verification to ensure projected savings are realized in practice.³⁹

Fourth, TENs should be included in the Commission evaluation of novel technologies.⁴⁰ TENs use shared underground piping to transfer heat pump buildings and the ground, allowing multiple structures to efficiently heat and cool through electrified heat pumps. By connecting clusters of buildings, TENs can reduce peak electric demand, lower system-wide infrastructure costs, and enable decarbonization in dense urban areas or hard-to-electrify building types where individual retrofits may be more expensive or technically constrained.

Including TENs in the 2025 Action plan is important for several reasons. First, they provide a scalable neighborhood-level solution that complements building-by-building electrification strategies. Second, shared-loop systems can improve affordability and equity by spreading costs across multiple customers and reducing the need for costly electric distribution upgrades. Third, TENs can leverage existing utility expertise in infrastructure planning, construction, and maintenance, offering a pathway for gas utilities to transition toward clean thermal services while preserving skilled jobs and workforce continuity.

This omission is particularly notable considering SB 1221, which directs the California Public Utilities Commission to evaluate the costs and benefits of TENs and to identify market, regulatory, and implementation barriers to their deployment. SB 1221 reflects clear legislative recognition that TENs may represent a scalable decarbonization strategy and warrants formal assessment of their GHG reduction potential, ratepayer impacts, infrastructure requirements, and workforce implications. The statute also calls for the identification of barriers that must be addressed to enable deployment.

³⁹ *Ibid.*

⁴⁰ *Id.* at p. 13.

Given this statutory direction, the 2025 Action Plan should not remain silent. At a minimum, the plan should acknowledge SB 1221's evaluation process, commit to interagency coordination, and outline how the Energy Commission would respond if the findings to support broader deployment. Incorporating TENs into the plan would ensure alignment with legislative intent, promote policy coherence across agencies, and position the state to act quickly on a potentially cost-effective, scalable infrastructure solution capable of accelerating building decarbonization while supporting workforce continuity and system reliability.

Fifth, expanding access to low-cost and zero-cost financing must be accompanied by strong consumer protections, administrative simplicity, and technical assistance.⁴¹ The Coalition recommends exploring financing partnerships with local unions or local building and construction trades councils to encourage high road contractors to participate in decarbonization efforts.

Sixth, as the Commission advances decarbonization strategies, explicit connections to job quality should be embedded in program design.⁴² Emissions targets should be paired with workforce development plans, measurable job quality standards, and reporting metrics. Decarbonization efforts that do not account for labor standards risk creating workforce shortages and inconsistent installation quality.

Seventh, efforts to empower homeowners with tools and information should prioritize clarity, accessibility, and integration.⁴³ Tools should provide transparent cost savings information, connect directly to incentives and financing, and include mechanism for identifying high road contractors. Consumer education must be paired with safeguards that maintain quality and accountability.

Eighth, strengthening alignment across agencies and levels of government will require more than coordination in principle.⁴⁴ Implementation should include streamlined applications, harmonized program requirements, shared data systems where feasible, and consistent compliance standards. Without operational alignment, participants may face duplicative processes that limit effectiveness.

⁴¹ *Ibid.*

⁴² *Ibid.*

⁴³ *Ibid.*

⁴⁴ *Id.* at p. 14.

Ninth, in advancing energy code compliance strategies,⁴⁵ the Commission should expand the focus beyond core adoption and inspection to include proper installation, commissioning, and verification practices. Training for contractors and adequate enforcement are essential to ensure that equipment performance is as intended. Code compliance without installation quality will not achieve projected performance outcomes.

Tenth, in designing building performance standards for large commercial and multifamily buildings,⁴⁶ the Commission should recognize that poor installation at larger projects will result in larger energy efficiency losses than poor installation in individual smaller projects, making workforce standards and Title 24 compliance verification even more important on a project-by-project level.

Eleventh, careful design is essential to any home energy rating and labeling program.⁴⁷ The program should avoid imposing unintended costs, ensure rating accuracy, and integrate incentives so that homeowners have clear pathways to act on the information provided.

Twelfth, in developing automated load flexibility programs, the Commission must ensure safety and reliability.⁴⁸

Thirteenth, improved data collection and analysis will be critical to guiding the energy transition.⁴⁹ However, to the extent gaps are already known, the Commission should prioritize addressing those gaps instead of studying them further. For example, the Commission should prioritize directly improving compliance with Title 24 requirements instead of studying compliance rates as the problem is already well known.

Fourteenth, as the Commission works to position heat pump as the leading technologies for building decarbonization,⁵⁰ implementation should include stable and predictable incentives, contractor training standards, quality installation requirements, and alignment with grid planning and rate design. Market transformation will depend on both consumer confidence and workforce readiness.

⁴⁵ *Ibid.*

⁴⁶ *Ibid.*

⁴⁷ *Ibid.*

⁴⁸ *Ibid.*

⁴⁹ *Id.* at p. 15.

⁵⁰ *Ibid.*

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The Commission, however, should not exclusively rely on heat pump technologies. Other decarbonization technologies, like thermal energy networks, must also be supported.

IV. CONCLUSION

The Coalition broadly supports the Commission's recommendations. By incorporating clearer workforce standards, expanding equity to include workers, strengthening installation quality and compliance mechanisms, ensuring consumer protection in financing and load flexibility, improving interagency coordination, and closing critical data gaps, the Commission can significantly strengthen implementation and ensure these policies achieve their intended environmental, economic, and equity outcomes.

In Attachment A to this comment letter, the Coalition includes proposed redlined changes to the 2025 Action Plan.

Sincerely,



Andrew J. Graf

Attachment
AJG:acp

ATTACHMENT A

Attachment A

Proposed Redline to Changes to Draft 2025 California Building Energy Action Plan

Page 1

The primary technological pathway to achieve the necessary GHG reductions in the building sector is clear — efficient, electric heat pumps that leverage carbon-free electricity must replace fossil fuel equipment as the primary means of providing space and water heating. The California Energy Commission (CEC) is working with other government agencies and the private sector to achieve the goal to install 6 million heat pumps by 2030. The cost of installing and running heat pumps is a barrier to adoption in many cases and strategies are needed to bridge this gap in affordability. This report presents strategies to encourage stakeholders and policymakers to address affordability effectively.

For new campuses, large developments, new neighborhood projects, district-scale decarbonization technologies – such as thermal energy networks – should be evaluated during the early planning and design phases as a potential means of providing low-emissions space heating, cooling, and domestic hot water. These development types are uniquely positioned to integrate shared thermal infrastructure cost-effectively due to coordinated site planning and aggregated building loads. Requiring early-stage feasibility assessment of networked thermal solutions can help avoid long-term infrastructure lock-in and ensure that new developments consider scalable, system-level approaches to building decarbonization alongside individual building electrification strategies.

Pages 4-5

- **Pursue residential electric panel optimization strategies to avoid unnecessary panel and service upsizing:** As existing buildings aim for electrification at scale, state policies must ensure that to the greatest extent possible building electrification does not trigger expensive electric grid infrastructure upgrades. This goal can be accomplished by adopting policies that allow or favor power-efficient devices (that is, devices that minimize panel load) and by properly sizing appliances, thus avoiding unnecessary electrical panel and service upsizing. Preventing building electrification from adding out-of-pocket costs to customers and triggering upstream infrastructure upgrades that add costs to all ratepayers will require innovation in low-voltage appliances, circuit-sharing devices, and meter-socket adapters, as well as educating field technicians on panel optimization strategies. These optimization strategies require qualified technical assessment to ensure safe implementation and accurate evaluation of

available electrical capacity. Such assessments should be performed by certified general electricians. In addition, evaluations should account for anticipated future electrical loads to ensure that the use of optimization measures does not constrain a building's ability to accommodate electric vehicle charging infrastructure.

Page 8

Building Decarbonization ~~Presents Opportunities to Expand California's Efforts Should Support the Expansion of Well-Trained~~ Clean Energy Workforce and the Creation of High Road Job Pathways for Local and Disadvantaged Workers

California will need to expand its clean energy workforce to meet its building decarbonization and equity goals. With roughly 300,000 Californians working in energy efficiency, the building decarbonization workforce is already the largest category of the clean energy workforce in California. Decarbonizing California's buildings could increase this number by 42,000 — 81,000 additional jobs on average annually through 2045. This effort will require increasing the current network of apprenticeship and other workforce programs.

Decarbonization programs should be structured to support the expansion of well-trained clean energy workforce by tying contractor eligibility, funding prioritization, or incentive levels to demonstrate investments in workforce training and job quality. Programs should prioritize participation by contractors that provide high-road career pathways for local and disadvantaged workers, including through participation in state-approved apprenticeship programs or equivalent training initiatives. Incorporating workforce development criteria into program requirements will help ensure that public investments in building decarbonization also advance equitable access to employment opportunities in the clean energy economy.

Pages 8-9

Increased Standards Compliance Is an Important Pathway to Building Decarbonization

The California Building Standards Code (also known as Title 24) is a comprehensive set of regulations that govern the design, construction, and maintenance of buildings in California. Of the twelve parts of Title 24, the CEC is the state adopting agency for the Energy Code (Title 24, Part 6), and voluntary energy efficiency standards in CALGreen (Title 24, Part 11). Code compliance for retrofits and replacements in existing buildings is generally considered to be low, particularly for HVAC systems. ~~While compliance with the Energy Code in new construction is understood to be high, compliance in existing construction is lower and less understood.~~ The CEC's Energy Code also applies to the change-out of

HVAC systems in existing buildings and is intended to ensure that new HVAC systems are installed and commissioned properly. However, Unpermitted work using unlicensed labor is a persistent problem in existing buildings and may undermine the effectiveness of decarbonization measures, create health and safety risks, and cultivate an unfair market for honest contractors. In addition, lack of enforcement of compliance documentation requirements, including HERS testing, acceptance testing and commissioning, may further limit the ability of installed systems to operate as intended.

Enforcement is generally the responsibility of local building departments, however, various government agencies, including the Contractors State Licensing Board, California Building Standards Commission, the Department of Housing and Community Development, the CEC, and many others, play supporting roles.

The CEC is making efforts to increase the usability of the Energy Code, most recently with the discontinuation of portions of the code that are outdated, reductions in supporting reference manuals, and compliance-focused improvements adopted in the 2025 Energy Code update. The CEC will continue to assess the scale of the opportunity and potential strategies to improve permit compliance, installation quality, enforcement of documentation requirements, and increase the usability of the code in consultation with the various state and local enforcement agencies.

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- Maintain focus on Equity.** Programs should focus the majority of funding on low-income and disadvantaged communities, which face the highest energy cost burdens, may not be able to afford the costs associated with building decarbonization, and may not have access to financing. Tenant protections should be a strong consideration in decarbonization programs. Low-income homeowners and landlords need broad access to low-cost financing to support projects and alleviate residents' energy burden. The CEC should continue developing targeted programs that focus on tribal needs, such as the Equitable Building Decarbonization Tribal Direct Install program. The equity impacts of decarbonization on plumbers should also be considered. Decarbonization strategies that create viable replacement job opportunities for plumbers should be prioritized. For example, thermal energy networks should be incentivized and encouraged in large campus development, as well as in new neighborhood or community-scale projects.

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- Continue investing in technology innovation.** Reducing first costs of heat pump installations and operating costs requires technology innovation.

For example, 120 Volt indoor air handlers can eliminate the cost of running electrical wiring to attics. Dual fuel heat pumps can also reduce the cost of installations by avoiding the need for new electrical capacity for backup resistance heating, while providing customers with heat at the lowest operating cost. Innovative thermostatic controls that minimize the use of gas in dual fuel systems reduce GHG emissions. Technologies such as low-voltage appliances, circuit-sharing devices, and meter socket adapters, as well as educating field technicians on panel-optimization strategies, should be used to minimize electrical panel and service upsizing and electric grid infrastructure upgrades. [Technologies such as thermal energy networks should also be used as a decarbonization solution for large campus development, as well as in new neighborhood and community-scale projects.](#)

6. **Expand the decarbonization workforce ~~with well-paid jobs~~ through support for high road job creation and prioritizing participation of high road contractors and adequately trained installers.** [“High road jobs” are jobs that offer family supporting wages, employer-provided benefits, worker voice, opportunities for advancement, and workforce education and training to help create a highly skilled and qualified workforce and to meaningfully improve workers’ economic mobility. Incentive programs that do not require the use of adequately trained installers create disincentives for contractors to invest in quality worker training since they must compete on price with low road contractors that hire installers with no qualifications for low pay and provide their workers with just minimal training. Incentive programs should be designed to encourage participation of high road contractors and to increase demand for apprentices, apprenticeships graduates, and other well-trained and qualified workers.](#) Develop a better understanding of the business barriers contractors face to expanding their decarbonization services, including training and upskilling needs along with business issues such as customer acquisition and project pipeline management. If funding is available, decarbonization programs could support contractors in overcoming these barriers, require competence in refrigerant management and recovery, and focus on bringing in workers from California Native American tribes and justice communities. Workforce development boards already provide funding and wrap-around support for trainees and apprentices which could be expanded if funding is available. Continue to invest in training for high-road jobs such as the Training for Residential Energy Contractor Program. ~~The glossary at the end of this report provides a definition for “high road” jobs.~~

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9. **Enhance Energy Code compliance strategies.** The CEC should continue to improve the usability of the Energy Code compliance systems, track heat

pump installations and rates of compliance in new construction and existing buildings, and increase stakeholder awareness of the potential impacts of noncompliance. The CEC can address these tasks by collecting datasets in the field that are more representative of a state as large and diverse as California. State agencies should coordinate technical assistance and support for local enforcement agencies. The CEC should quantify unpermitted and noncompliant retrofit work, and, as discussed in the Space Conditioning and Water Heating Equipment Data Tracking proceeding (24-OIR-03), ensure that any statewide tracking system is designed to allow identification of nonpermitted installations to enable enforcement. In parallel, the CEC should prioritize policies that incentivize the use of well-qualified installers, as workforce training rates remain low and improperly installed HVAC systems can result in up to 30% efficiency losses. Finally, greater attention is needed to improve compliance with Energy Code documentation requirements, particularly related to commissioning, Energy Code verification, acceptance testing, and lighting controls, to ensure installed systems achieve their intended performance and energy savings.

Page 15

14. Create and sustain market conditions ~~that position~~ accelerate the adoption of heat pumps ~~as the leading technology for decarbonizing buildings and other building decarbonization technologies~~. The state should create productive relationships with heat pump manufacturers and other market actors, including through the Heat Pump Public-Private Partnership, to leverage the resources of private companies to develop new products, reduce costs, ensure installation quality, and support contractors in the development of heat pump business models. The State should also support the development of markets for other decarbonization technologies such as thermal energy networks.

Pages 46-47

Barriers

- Longer-term studies (beyond the typical time horizon of CEC-funded grants) are needed to resolve health impacts.
- It is difficult to access a representative sample of homes, including multifamily units or units in justice communities or both.
- Modeling tools struggle to quantify and value the health impacts of indoor air quality. The models are complex and can vary significantly based on home characteristics and resident health profiles.
- Mechanical ventilation systems in low-income housing often do not have sufficient airflow to reduce criteria pollutant levels.

- [The health benefits of building decarbonization depend on proper equipment installation.](#)

Opportunities

- Support for epidemiological research relevant to decarbonization policy could provide an improved scientific foundation for policy and programs to improve the health of residents and benefit energy ratepayers, while supporting the building energy transition in California.
- Partnerships with community-based organizations can help access homes and increase participation rates in studies.
- Developing metrics and improving technical modeling tools can help access the impacts of indoor air pollution, characterize the health risk reduction resulting from building electrification, and allow the health benefits of decarbonization to be quantified financially to support programs and regulation.
- Empirical field data from new California buildings could help validate new building energy efficiency standards for residential and commercial kitchen ventilation.
- [Increased permitting compliance, together with stronger installation and workforce standards, can significantly improve public health benefits.](#)

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High-road jobs are ~~those jobs~~ that [offer family-supporting pay-a living wages, employer-provided benefits opportunities for promotion, worker voice, guarantee safe working conditions, and may offer other benefits opportunities for advancement, and workforce education and training to help create a highly skilled and qualified workforce and to meaningfully improve workers' economic mobility.](#)

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Existing Activities to Build Workforces

For years, many institutions and entities throughout California have administered programs to train and employ workers in emerging fields related to clean energy, electrification, and building decarbonization. These programs include multiyear apprenticeships, community college programs for career entry, and short-term certification-preparation courses for unemployed or underemployed workers. Short-term training [are most useful for programs can teaching already trained and experienced installers underemployed construction workers new skills and help them obtain certification for HVAC retrofits and installing other equipment needed to meet California's decarbonization goals. Manufacturer equipment installation training and other short-term training courses may have some impact on](#)

[installation quality, but are not a substitute for comprehensive training crafted to provide the knowledge, skills, and abilities needed to ensure quality installation, such as provided by state-approved apprenticeship programs](#)

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Another well-established approach to local workforce development is to use project labor agreements (PLAs). PLAs are incorporated into construction contracts through negotiations between construction unions and construction employers to ensure that contractors use local, credentialed labor for a specific construction project. The primary goal of PLAs is to ensure the use of local labor, set wages and benefits, and establish no-strike, no-lockout clauses. PLAs may also ensure other goals are met, such as requiring a certain percentage of workers are apprentices or meet other criteria. PLAs are typically applied to union or prevailing wage contracts but may also be applicable to market-rate contracts. A notable use of PLAs is in the City of Los Angeles, which entered into a PLA with the Los Angeles/Orange County Building and Construction Trades Council for the construction of affordable housing under its Proposition HHH. [In addition, PLAs provide a guarantee of access to a well-trained workforce, which can improve installation and energy efficiency outcomes.](#)

The California Department of Industrial Relations (DIR) engages in and administers workforce development activities that help create and maintain local high-road jobs through the Division of Apprenticeship Standards (DAS) and the California Apprenticeship Council (CAC). The DAS administers California apprenticeship law and establishes apprenticeship standards for wages, hours, working conditions and the specific skills required for state certification as a journeyman in an apprenticeable occupation. The DAS promotes apprenticeship training, consults with program sponsors, and monitors programs to ensure high standards for on-the-job training and supplemental classroom instruction. A contractor that is awarded a public works project is required to notify the relevant apprenticeship committees, employ apprentices, and make training fund contributions to an approved apprenticeship committee or to the CAC. [However, public works regulations provide several exceptions to this requirement for non-union contractors. These exceptions can be closed by PLAs. Public Contract Code section 2600 expressly permits public entities to require contractors to enter into a PLA for a construction project if the agreement complies with certain enumerated taxpayer protection provisions.](#)

Pages 83-84

The TECH program provides [training for consumers, contractors, and vendors](#) ~~training,~~ [but it does not currently offer meaningful installer training or require participating contractors to provide their installers with adequate training to help](#)

meet ~~the~~ local workforce needs ~~for a skilled and trained workforce~~. This gap presents a missed opportunity to ensure that installations are performed by a skilled and properly trained workforce. However, the program is well positioned to help support and incentivize participation by high road contractors that invest in meaningful training and create high road job opportunities for local residents, including through participation in state-approved apprenticeship programs. The TECH program should be encouraged to refresh its design to support, incentivize, and prioritize participation by contractors that provide meaningful training to their workers and contribute to the development of a well-trained workforce.

The EBD Direct Install Program requires program administrators to “propose, implement, and measure results of a workforce plan with the goal of ensuring high-quality installations and creating local, high-quality jobs in the communities served.”²⁰⁷ The EBD program also requires administrators to provide preference for contractors that source workers from local areas.²⁰⁸ California received a \$10 million allocation to administer the TREC program, which will provide training and education to support contractors installing residential electrification improvements. The workforce training will help support the HOMES, HEEHRA, and the EBD Direct Install Program.²⁰⁹

The 2019 Energy Action Plan recommended developing a statewide plan for the future of the gas system that protects workers, communities, and ratepayers. As the electric utility sector grows, the gas infrastructure and delivery workforce may decline by a similar amount, as shown in Table 13. Retraining workers from gas utilities, and contractors who specialize in gas equipment, may be one way to provide a pipeline of new but experienced workers who can conduct decarbonization retrofits.

Just Transition

The equity of building decarbonization on plumbing trades should be considered in program and technology planning decisions. As California advances policies to electrify building end uses, including space and water heating, it is important to recognize that these transitions may significantly alter the scope and availability of work traditionally performed by plumbing professionals. Absent deliberate policymaking, decarbonization incentives may unintentionally contribute to workforce disruption by reducing demand for certain plumbing services without creating comparable high-road employment opportunities that leverage existing skill sets.

Decarbonization solutions that create comparable employment opportunities and support skill transfer for plumbers, including continuity of work within state-approved apprenticeship pathways, should therefore be prioritized where feasible. Incorporating workforce transition considerations into program design can help

ensure that investments in building decarbonization also support job quality, workforce stability, and equitable access to career pathways in the clean energy economy.

For example, thermal energy networks (“TENs”), which rely on significant piping infrastructure for the distribution of heating and cooling, may provide demand for plumbing-related skills and offer a viable pathway for maintain high-road employment opportunities within the plumbing trades. Incentivizing and encouraging the deployment of such systems in large campuses, neighborhood, or community developments, where shared thermal infrastructure can be integrated during early planning and design phases, may help align decarbonization objectives with workforce equity goals while minimizing potential trade displacement effects.

Barriers and Opportunities: Building Local Workforces

Barriers

- There is a shortage in the workforce needed to install decarbonization retrofits to meet California’s 2045 decarbonization goals.
- Decarbonization programs ~~may be less cost-effective if contracts with high-road jobs, such as union labor or prevailing wage jobs, are part of program requirements~~should not assume that requirements supporting high-road jobs reduce cost-effectiveness. Labor should be considered an investment in quality, reliability, and long-term workforce capacity. Cost-effectiveness assessments should account for lifecycle performance, realized savings, and the public benefits associated with a skilled and stable workforce.
- Incentive programs that do not require the use of adequately trained installers create disincentives for contractors to invest in quality worker training since they must compete on price with low road contractors that hire installers with no qualifications for low pay and provide their workers with just minimal training.

Opportunities

- The anticipated growth in jobs statewide can be used to leverage the funding required to support apprenticeships, retraining, and upskilling workers.
- Existing approaches such as PLAs can be used to ensure that new jobs are kept in justice communities. Apprentices can benefit from career pathways leading to growth in job opportunities.
- An existing system of workforce development programs, including community colleges, nonprofit organizations, local workforce investment boards, and job placement agencies, can be leveraged to prepare students to join the clean energy workforce.

- Establishing partnerships and agreements between decarbonization programs and local workforce development boards could maximize participation in decarbonization programs.
- LWDBs could use funding to improve their effectiveness and help meet upcoming needs for decarbonization retrofits.
- Workforce standards ensure that incentive dollars support contractors who adequately train their workers and consistently deploy a qualified workforce on decarbonization projects.
- Incentive programs should be designed to encourage participation of high road contractors and to increase demand for apprentices, apprenticeships graduates, and other well-trained and qualified workers.
- The TECH program should be redesigned to allow it to support, incentivize, and prioritize participation by high road contractors that provide meaningful training to their workers.
- Establishing partnerships and agreements between decarbonization programs and local building and construction trades councils could maximize participation of skilled, local workers in decarbonization programs, increase apprenticeship opportunities, and support high road job creation.

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Avoiding Electric Panel Upsizing

Building owners, contractors, utilities, and building officials can avoid upsizing electrical panels unnecessarily by assessing the need for panel upsizing accurately at the beginning of an electrification project and selecting building electrification and energy efficiency measures that minimize peak loads. Avoiding upsizing electrical panels requires accurate peak load calculations, and measures that minimize peak loads including efficient loads, low power loads, load flexibility, and load sharing, as discussed below.

Electrical load optimization strategies can play an important role in enabling building electrification without requiring costly service upgrades; however, these approaches require qualified technical assessments to ensure safe implementation and accurate load calculations at the panel and circuit level. To mitigate safety risks, such assessments should be performed by certified general electricians. In addition, these strategies should be evaluated to ensure they do not create unintended constraints on future electrical capacity needed to support the State's transportation electrification goals, including the installation of electric vehicle charging infrastructure. Establishing appropriate assessment requirements will help ensure that near-term optimization measures do not limit long-term electrification potential or undermine progress toward EV adoption targets.

Rates of Permit Compliance and Code Compliance

There are limited data on rates of permit compliance and whether the resulting installations comply with code or perform optimally. [The Strategic Plan to Reduce the Energy Impact of Air Conditioners found that poor-quality HVAC installations can increase energy use by 20 to 30 percent, effectively erasing much of the expected efficiency benefit. The report also found that as many as 85 percent of replacement HVAC systems are installed incorrectly and that contractors complied with Title 24 quality installation requirements only about 15 percent of the time. The report estimated that if permit and inspection requirements were consistently followed, California’s peak electricity demand could be reduced by approximately 130 megawatts annually.](#)

The 2014–16 HVAC Permit and Code Compliance Market Assessment Report estimates that between 8 percent and 29 percent of single-family residential HVAC installations are permitted and states that the research team is “confident that the true permit rate lies between the two estimates.” The report cites previous studies that estimate the compliance rate between 10 percent and 38 percent, based on smaller sample sizes. [The report concludes that permitting compliance alone is not enough to achieve meaningful energy efficiency outcomes.](#) The report did not investigate compliance rates for water heaters.

~~The report also investigated the consequences of nonpermitted work and found “[t]here are few statistically significant differences in the energy efficiency of permitted and non-permitted installations.” For permitted and nonpermitted work, the rate of code compliance was between 58 percent and 100 percent for most code requirements. However, for duct leakage requirements, compliance was 56 percent for permitted installations (n=84) and 47 percent for non-permitted installations (n=64); for airflow requirements, compliance was 26 percent for permitted installations (n=39) and 14 percent for nonpermitted installations (n=22).~~

~~The low compliance rate for airflow requirements and the difference between permitted and nonpermitted installations could be explained by the change in airflow requirements in the Building Energy Efficiency Standards in 2013, from 300 cubic feet per minute (cfm) per ton to 350 cfm per ton. Contractors who typically pull permits may be more aware of code changes because they are more likely to receive written guidance or have conversations with local building officials. Code compliance may therefore be more important for issues where the code requirements change from one cycle to the next.~~

Barriers

- The economic value of recovered refrigerant is often lower than the cost of recovering it. The difference in economic value of recovered refrigerant and recovery costs is changing under U.S. EPA law, California law, and CARB regulations, which aim to increase the use of reclaimed refrigerants and require the use of lower-GWP refrigerants.
- Recovering used appliances from consumers does not guarantee refrigerant recovery and reclamation because there is uncertainty about what happens to appliances once they enter the municipal waste stream.
- Not all contractors have the necessary equipment to recover refrigerants properly or rapidly, particularly for newer refrigerants in the market. Even if recovered, transporting recovered refrigerant to a reclamation facility may be challenging because there is a small number of facilities.
- [The switch from “non-flammable refrigerants” to lower GHG, “low-flammable refrigerants” requires increased installation care for safety.](#)

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- Requiring ~~periodic continuing education and evaluation of technician refrigerant handling techniques could~~ [completion of, or enrollment in, a state-certified apprenticeship program or equivalent journey-level qualification to](#) ensure technicians are accountable and competent. The relevant state agencies could mandate training for recertification and continuing education in addition to U.S. EPA 608 certification requirements.
- Very-low-GWP equipment specific to California that is under development could allow programs to offer incentives for these products ahead of CARB’s implementation of refrigerant sales regulations. One example is CARB’s F-gas Reduction Incentive Program, which offers incentives to replace high-GWP refrigerants with ultra-low-GWP alternatives for large commercial and industrial refrigeration facilities. 347
- [Requiring certification of installers for new or replacement systems using refrigerants could help reduce leaks and improve safety during operation.](#)

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High-road jobs are ~~those jobs~~ that [offer family-supporting pay a living wages,](#) [employer-provided benefits, worker voice,](#) opportunities for [advancement, promotion, guarantee safe working conditions, and may offer other benefits and workforce education and training to help create a highly skilled and qualified workforce and to meaningfully improve workers’ economic mobility.](#)