Bay Area Air District

CLEAN AIR FOR ALL

Appendix F

Workforce Planning Analysis

March 2026

Bay Area Regional Climate Action Plan

[bw] RESEARCH PARTNERSHIP

MEMORANDUM

To **Bay Area Air District**

From **BW Research Partnership**

Date **January 26, 2026**

Re **BARCAP Workforce Analysis**

Introduction

This memorandum summarizes the workforce planning analysis conducted by BW Research Partnership in support of the Bay Area Air District's Comprehensive Climate Action Plan (CCAP): the Bay Area Regional Climate Action Plan (BARCAP). This memo:

- Identifies current employment in the Bay Area within each of five BARCAP sectors;
- Provides estimates of future workforce demand in all five sectors;
- Determines key occupations critical to achieving the goals outlined in the BARCAP measures;
- Presents training and education requirements that are critical to developing a strong workforce within these key occupations;
- Outlines the ecosystem of key stakeholders and initiatives currently happening in the region;
- Analyzes workforce opportunities for low-income and disadvantaged communities.

The workforce projections discussed throughout this memo were developed by identifying relevant research highlighting activities similar to the measures in the BARCAP. While these studies are often imperfect representations of the full range of BARCAP activities, they are inclusive of the respective measures, align with the scope of the activities to be conducted and the types of occupations to be created, and address both the challenges and opportunities involved in building a workforce capable of meeting BARCAP goals. Future analyses geared towards providing policymakers and training providers with detailed anticipated workforce estimates may consider utilizing novel, tailored economic impact models built on programmatic cost data or labor-intensity tools to more accurately forecast the quantitative needs for specific occupations. For more information about how the employment estimates were developed, please review the appendix section of this memo beginning on page 44.

The reports utilized for future workforce estimates also highlight specific occupations which will be vital to the successful deployment of the proposed BARCAP measures. Although these are not the only occupations that will be in-demand through these activities, the occupations listed are among those that appeared most frequently within existing literature and labor market data, and a sustained shortage of

these workers would hinder the success of the BARCAP measures. For the remainder of this memo, these occupations are referred to as "priority occupations."

The measures identified in the BARCAP provide opportunities for "high road" jobs that are well-paying, stable, and provide career pathways in growing climate and clean energy sectors.[1] Meeting the demand for these jobs with a supply of qualified and trained workers will require a commitment to partnership and investment in workforce development activities—including workforce development boards that carry out much of this work—all while providing work opportunities and pathways to individuals from all communities within the region.

As is highlighted in each sector's ecosystem section, there are many climate-related workforce initiatives already in existence throughout the BARCAP region. This means that new programs are unlikely to be needed. Instead, existing programs can be expanded, and best practices can be shared across local governments to meet workforce needs created through these BARCAP measures. Many of these programs reside within or are adjacent to each of the county's workforce development boards, though other parties involved in energy and climate—including utilities and community choice aggregators, climate tech manufacturers, educational institutions, and non-profits—have programs that can be replicated or scaled to support these workforce needs. Convening these stakeholders, sharing best practices, and coordinating funding are just a few ways that existing efforts can be synthesized for maximum impact throughout the region.

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Transportation Sector

Current and Future State of the Workforce

The transportation sector is both the Bay Area's largest source of greenhouse gas (GHG) emissions and one of its greatest opportunities for strategic transformation. Currently, the sector employs nearly 135,000 workers[2] in the BARCAP region and an estimated average of 33,000 additional workers[3] [4] are needed to work full-time from 2020 to 2045 to meet the broader climate goal of decarbonizing the transportation sector. These employment forecasts from the University of California's Institute of Transportation Studies are based on the complete decarbonization of the transportation sector by 2045 to zero-emission vehicles (ZEVs), which includes a rapid conversion to battery-electric vehicles (BEVs), plug-in hybrid vehicles (PHEVs), and hydrogen fuel cell vehicles (FCEVs). This conversion requires additional activities, like the installation of electric charging and hydrogen fueling station infrastructure throughout the state, as well as the generation and procurement of those resources (electricity and hydrogen). The scenario from the study is more aggressive than BARCAP measures T-1 and T-2 but covers similar activities.

Measure T-3, which includes policies to reduce GHG emissions from goods movement and delivery, may have some workforce impacts that are not fully accounted for in transportation fuel switching. Measure T-4, which aims to reduce passenger vehicle miles traveled through land use and greater use of transit, biking, and walking, will require additional buildout of infrastructure. Adjusting one statewide study[5] of a broader package of related transit measures to the BARCAP region suggests that nearly 15,600 workers could be sustained through the construction of additional non-passenger motor vehicle-related transportation infrastructure.[6]

Alongside a significant number of new workers, this transition will also introduce new technical challenges; while electric motors share some similarities with internal combustion engines (ICE), they differ in important ways that require additional training, specifically for safe handling of high-voltage electrical systems. Hybrid vehicles also add another layer of complexity. As the transportation sector evolves, many current workers will need to expand their expertise to include emerging technologies, such as Electricians upskilling their knowledge of vehicle charging infrastructure and battery systems. These new challenges reinforce the need for specialized training programs for technicians as well as first responders who can ensure safety in an increasingly electrified transportation system. The Bay Area California Jobs First Initiative is investing heavily in this space, identifying battery manufacturing as a priority sector for the region. This means job opportunities in battery research and development, design, and manufacturing are likely to increase in the coming years as economic development investments and strategies take effect.

Additionally, the widespread adoption of EVs is expected to reduce demand for routine maintenance services, as these vehicles require fewer oil changes and engine repairs than ICE vehicles,[7] highlighting potential workforce disruptions and the need for proactive planning to support displaced workers and assist them in transferring their skills to new clean transportation jobs. At the same time, changes to this sector will drive potential losses at refineries as demand for fossil fuels declines (see "Power Sector"). A 2023 report on the economic impacts of a refinery closure in the Bay Area found that former refinery workers typically earn lower wages at their new jobs once re-employed.[8] While opportunities for refinery workers may exist in other growing areas of the clean energy economy, these opportunities may be located elsewhere in or outside of the BARCAP region, may require upskilling or additional education on new technologies such as hydrogen, or may not appear in significant numbers immediately while funding and construction of these projects are finalized. An intentional focus on these displaced workers is essential to a just transition.

The Transportation Sector has a mixture of union and non-union employment. Drivers and service providers of municipal fleets are often members of unions and have job protections, though mechanics at private automotive repair shops for passenger vehicles likely do not have these same benefits and protections. This means that these workers—who may also be most exposed to job loss via the transition to electric vehicles—require additional attention from policymakers to pre-empt large shifts in employment.

Occupational Analysis

The sector's workforce spans sales, installation, and maintenance roles—Retail Salespersons who introduce consumers to EVs, Electricians and Electrical Installers and Repairers who install, maintain, and repair vehicle charging stations, and Automotive Service Technicians who maintain fleets. These occupations have a smaller concentration of workers in the region than in the overall nationwide economy, likely due to the presence of many different industries and sectors in the Bay Area's economy, but will be critical to ensuring reliable access to ZEVs and the infrastructure that supports them. Compensation across most of these roles exceeds the regional median,[9] with the Electricians and Electrical and Electronics Installers and Repairers in particular providing stable, living wages for a family of two working adults and two children.[10]

Table 1: BARCAP Region Transportation Sector Occupations

Occupation	Total Employment[11]	Employment Percent Change (2022-2032)[12]	Location Quotient[13]	Median Hourly Wage[14]
Retail Salespersons	51,398	-2.4	0.73	$20.86
Electricians	12,362	18.3	0.85	$45.90

Automotive Service Technicians and Mechanics	10,684	5.2	0.74	$36.06
Electrical and Electronics Installers and Repairers, Commercial and Industrial Equipment	812	0.0	0.76	$46.24

Workforce preparation across these roles varies; sales roles often only require limited formal training, while trades roles often require apprenticeships, licenses, and an associate's degree or certification. Together, these occupations ensure that consumers can purchase EVs, that the vehicles are safely maintained, and that charging infrastructure is accessible and reliable—all of these functions are essential to successfully meeting the region's transportation decarbonization goals. Thus, building a cohesive pipeline that can train all these diverse roles while expanding access to technical training and apprenticeships for trades roles will be essential for making the ZEV transition both practical and equitable.

Table 2: Transportation Sector Occupational Education & Training Analysis[15]

Occupation	Role Within Sector	Minimum Education Requirement	Minimum Training Requirement	State License Requirements	Other Common Credentials
Retail Salespersons	ZEV sales	High school diploma or equivalent	Up to one year OTJ training	N/A	Vehicle Salesperson License[16]
Electricians	ZEV charging installation	Post-secondary certificate	One to two years OTJ training; recognized apprenticeship	State Electrical Contractor License	N/A
Automotive Service Technicians and Mechanics	ZEV repair and maintenance	Post-secondary certificate	One to two years OTJ training; recognized apprenticeship	CA Bureau of Automotive Repair (BAR) approved certification program; Automotive Service Excellence (ASE) certification exam	N/A
Electrical and Electronics Installers and Repairers, Commercial	Repair and maintenance of ZEV charging software /equipment	Associate's degree	One to two years OTJ training; recognized apprenticeship	N/A	American Society for Testing and Materials (ASTM)

and Industrial Equipment					International certifications; Electronic Technicians Association (ETA); National Center for Construction Education and Research (NCCER) certifications

Ecosystem of Key Stakeholders and Programs

Many partners are already mobilizing resources to advance workforce development initiatives and projects aligned with BARCAP measures. In the transportation sector, regional agencies such as the Metropolitan Transportation Commission/Association of Bay Area Governments (MTC/ABAG) and local transportation and transit agencies play a central role in shaping long-term strategies in transportation electrification. Table 12 highlights some key organizations and initiatives providing or supporting workforce training. See the appendices to this document—Appendix B: Ecosystem of Initiatives Across BARCAP Sectors and Appendix D: References —for initiatives and efforts that apply to all five sectors and links to programs, respectively.

Table *3*: Bay Area Key Organizations and Initiatives in the Transportation Sector[17]

Organization / Initiative / Program	Description
High Road Clean Transportation Career Pathways - West Oakland Job Resource Center	Partnership supporting workforce pipelines into EVs, charging infrastructure, and clean transit
Zero Emission Bus University (ZEBU)	AC Transit's program training mechanics and operators in zero-emission bus technologies
CalTrans Workforce Development Branch	Provides pre-apprenticeship training and career pathways in transportation and construction for youth and adults to increase the participation of women, minorities, and other disadvantaged individuals in skilled crafts
Electric Vehicle Infrastructure Training Program (EVITP) - California Energy Commission	Provides certification training for electricians to install electric vehicle charging equipment required for state-funded infrastructure projects
California Transit Works! (CTW)	A statewide consortium uniting transit agencies, unions, and colleges to expand high-road transit workforce partnerships centered on equity, worker voice, and clean-energy transit solutions

Contra Costa Harnessing Change: Refinery Transition Partnership (CCRTP)	Brings together refinery workers and community stakeholders to plan for equitable economic transition as Contra Costa County shifts from oil refining to low-carbon industries
West Oakland Job Resource Center (WOJRC) Regional Transportation, Distribution and Logistics (TDL) Workforce Institute and Expansion	Expands pre-apprenticeship and training programs that prepare Oakland residents for clean, equitable jobs in transportation, distribution, and logistics sectors

Building Sector

Current and Future State of the Workforce

The building sector currently supports around 60,000 workers in the BARCAP region through various energy efficiency activities.[18] The region may require 260 additional workers to support the BARCAP building sector goals to install heat pump upgrades and displace NOx-emitting equipment through early replacement initiatives.[19] This forward-looking employment estimate is based on the projected workforce impacts of 100% electrification of California's existing and new buildings adjusted to the total share of equipment projected to be replaced through BARCAP measure B-1.

While the three building measures in the BARCAP do not align perfectly with the full scope of building retrofits identified in the *UCLA California Building Decarbonization Workforce Needs and Recommendations* report, the BARCAP measures are all necessary to achieve the California Air Resource Board's goal of carbon neutrality in the building sector by 2045 while ensuring that the path to carbon neutrality is equitable and particularly supportive of workers and those who live in frontline communities. The 2019 statewide report is based on 100% decarbonization of buildings and suggests that an additional 12,400 full-time jobs across California in electricity generation and distribution could be created by 2045.[20] This estimate is based on an assumption of full building decarbonization and does not reflect the more limited and specific measures outlined in the BARCAP. While it should be interpreted as an upper-bound estimate much greater in scope than the BARCAP measures, this demand for meeting California's decarbonization goals should be noted by policymakers for future planning purposes.

While the workforce estimates cited above are greater in magnitude than the workforce impacts likely to arise from the BARCAP measures alone, the BARCAP measures represent an important step towards achieving sector goals, and the occupations and skills needed remain the same. Additionally, the transition is expected to be largely additive in terms of workforce; while the natural gas workforce may decline over the long term, this shift to buildings that operate on renewable electricity is projected to occur over time, and new demand from the transition to electrification will outweigh potential losses in the near term. A substantial portion of the natural gas workforce already possesses transferable skills—such as familiarity with technical systems, engineering principles, and health and safety protocols—that position them well for emerging roles in building electrification; however, targeted upskilling will be necessary to align with the evolving demands of energy-efficient technologies. For example, while plumbers are typically trained to size, install, and maintain conventional natural gas water heaters, the growing adoption of heat pump water heaters introduces new technical requirements around proper installation, commissioning, and maintenance.[21] Trades workers will need to upskill in areas such as siting, electrical integration, refrigerant flow management, condensate plumbing, and utility coordination, building on their existing general trades knowledge.

Occupational Analysis

Five skilled trades occupations—Carpenters; Construction Laborers; Electricians; Plumbers, Pipefitters, and Steamfitters; and HVAC Mechanics and Installers—will be critical to this transition. Thousands of workers are already employed in these roles, and expanding this workforce is not only necessary for the BARCAP but also presents significant economic opportunity, as all five occupations offer wages above the regional median of $33.93 per hour,[22] providing a living wage[23] for single earners and sustaining income for families with two working adults and one child.[24]

Table 4: BARCAP Region Building Sector Occupations

Occupation	Total Employment[25]	Employment Percent Change (2022-2032)[26]	Location Quotient[27]	Median Hourly Wage[28]
Carpenters	19,303	10.6	1.19	$40.34
Construction Laborers	18,842	13.0	0.73	$36.07
Electricians	12,362	18.3	0.85	$45.90
Plumbers, Pipefitters, Steamfitters	8,057	11.7	0.91	$36.18
HVAC Mechanics and Installers	6,142	15.5	0.78	$37.65

The successful preparation of this workforce depends on robust pipelines that combine classroom instruction, on-the-job (OTJ) training, and industry-recognized credentials. While these roles do not necessitate a college degree, the technical and safety-sensitive nature of the work requires structured pathways of apprenticeship training and hands-on learning. While roles such as Construction Laborers are suitable for more entry-level workers and require fewer prerequisites, most trades—including Carpenters, Electricians, Plumbers, and HVAC Mechanics and Installers—often require more structured pathways through vocational education, registered apprenticeships, and state licensing.

Appropriate training and certification for workers within the building sector is crucial to ensuring that building retrofits and new construction are completed with high standards, safeguarding worker and occupant safety and comfort. The building retrofit marketplace is generally split between large-scale construction projects (i.e. commercial, multifamily, industrial, etc.) typically conducted by larger and primarily union-signatory employers, and the single-family market which is served by smaller contracting companies staffed by workers who may receive little or no training in safety or the latest energy-efficient technologies. Current pilot programs, such as one pilot program run by the City of Berkeley, focus on the aggregation of single-family home retrofits to make them more cost-efficient to implement and therefore more feasible for larger commercial contractors that may incorporate high road labor

standards and training requirements. The California Workforce Development Board funded a High Road Training Partnership for Building Decarbonization, which aims to improve residential building retrofit labor and training standards throughout the Bay Area.[29]

The ability to implement building sector actions will hinge on sustained investment in hands-on skill development in the trades. Aligning these pathways with emerging building technologies like electric heat pumps and removing barriers to participation will be pivotal to ensuring that the region has enough skilled professionals.

Table 5: Building Sector Occupational Education & Training Analysis[30]

Occupation	Role Within Sector	Minimum Education Requirement	Minimum Training Requirement	State License Requirement	Other Common Credentials
Carpenters	Construct/install wood structures and fixtures within building infrastructure	High school diploma or equivalent	Up to a year OTJ training; recognized apprenticeship	State Carpentry and Cabinet Contract License	N/A
Construction Laborers	Perform a wide range of construction tasks with a variety of materials on building infrastructure	High school diploma or equivalent	Up to one year OTJ training	N/A	Occupational Health and Safety Administration (OSHA)[31] certification typically required; specialized tasks may require additional certification; National Center for Construction Education and Research (NCCER)[32] certifications
Electricians	Install electrical systems within building infrastructure	Post-secondary certificate	One to two years OTJ training; recognized apprenticeship	State Electrical Contractor License	N/A
Plumbers, Pipefitters, Steamfitters[33]	Install water heating and piping systems within building infrastructure	Post-secondary certificate	One to two years OTJ training; recognized apprenticeship	C-36 Plumbing Contractor License (for Plumbers/ Pipefitters); C-4 Steamfitting Contractor License (for Steamfitters)	N/A

HVAC Mechanics and Installers	Install HVAC systems within building infrastructure	Post-secondary certificate	One to two years OTJ training; recognized apprenticeship	State HVAC Contractor License; EPA Section 608 certification[34]	North American Technician Excellence® (NATE) certification[35]

While most building decarbonization activities require knowledge and skills that many contractors already have (e.g. most employers noted that new or additional heat pump-related training was not necessary for their workers),[36] some key building decarbonization technologies still require increased familiarity among contractors. One example is heat pump water heaters, which require knowledge of both plumbing and electrical systems; workers with expertise in just one of these areas may not be comfortable with their installation and maintenance. Addressing these gaps and providing targeted training for these technologies will be critical for ensuring workforce readiness.

Ecosystem of Key Stakeholders and Programs

The Bay Area is home to a dynamic ecosystem of organizations and initiatives that are actively supporting the workforce needed to accelerate the building decarbonization transition. Numerous initiatives are already underway to equip current workers with new skills and create pathways for new entrants into the workforce. However, additional investment and collaboration will be essential to scale these efforts to meet BARCAP goals. Table 3 highlights some key organizations and initiatives. See appendices to this document—Appendix B: Ecosystem of Initiatives Across BARCAP Sectors and Appendix D: References — for initiatives and efforts that apply to all five sectors and links to programs, respectively.

Table 6: Bay Area Key Organizations and Initiatives in the Building Sector[37]

Organization / Initiative / Program	Description
Bay Area Regional Energy Network (BayREN)	Regional network that provides contractor training, education, and workforce forums to support energy efficiency; offer training courses[38] in solar PV and storage systems, heat pumps, HVAC systems, energy code permitting and compliance, zoning codes, and sustainable home real estate
California Heat Pump Partnership	As described in their 2025 Blueprint, the Partnership aims to form a Workforce Advisory Council and launch a comprehensive initiative to support technical training, contractor engagement, and potentially develop a contractor certification program
City of Berkeley's Just Transition Residential Electrification Pilot	Supports workforce training in home electrification with a focus on equity and just transition
California Energy Commission Training for Residential Energy Contractors (CA-TREC)	State-supported training to equip residential contractors with skills in building performance and energy efficiency

Construction Trades Workforce Initiative (CWTI)	Workforce pipeline program expanding access to apprenticeships and careers in the construction trades
Catalyzing Quality Careers in Building Decarbonization - Rising Sun Center for Opportunity	Workforce partnership advancing equitable access to high-quality jobs in building decarbonization fields
East Contra Costa Healthy Homes Collaborative - Richmond Community Foundation	Community-driven effort advancing electrification, housing justice, and high-road job creation for frontline Contra Costa residents
JobTrain	Nonprofit that provides training, life supports, and job placement services to help underserved community members build sustainable careers in high-demand fields
Bay Area E-Contractor Academy - Emerald Cities Collaborative	Multi-week workshop series for small, minority-/women-/veteran-owned contractors to build technical, business, and operational capacity in electrification, energy efficiency, renewable energy, and green retrofit construction
Opportunity Build - Rising Sun Center for Opportunity	Free 10–12 week pre-apprenticeship program offering classroom and hands-on construction training, plus a year of job placement and retention support
Climate Careers - Rising Sun Center for Opportunity	Paid work experience program where youth gain hands-on job skills while contributing to local climate action projects
Catalyzing Quality Careers in Building Decarbonization - Rising Sun Center for Opportunity	Trains low-income job seekers of color for equitable, high-road careers in building electrification and energy efficiency
High School Girls Construction Camp - Trades Women, Inc.	Introduces high school girls to construction careers through hands-on training, mentorship, and leadership development to increase women's participation in the trades
City Build - San Francisco Office of Economic and Workforce Development	Construction pre-apprenticeship offering technical training, certifications, and pathways into union apprenticeships for San Francisco residents
Workforce Development Services - Family & Child Empowerment Services (FACES)	Job readiness and placement program connecting San Franciscans with employment opportunities across diverse industries including construction and trades
SEI's Energize Careers	Helps underrepresented individuals access paid green trade experience and long-term employment in energy efficiency and electrification sectors
Installation Basics Training 200 (IBT 200) - GRID Alternatives	Solar installation and workforce training program preparing participants for immediate employment in the solar industry
NextGen Trades Academy - Lime Foundation	Pre-apprenticeship program helping youth gain construction trade skills and employment pathways without requiring college

Construction Industry Workforce Initiative	Targeted to young urban adults from lower-income households to provide career development opportunities in Construction, Real Estate Development, Architecture and Engineering, Civic Engagement, and Urban Design
Equal Representation in Construction Apprenticeship (ERiCA) Grant - Department of Industrial Relations	A statewide initiative expanding access to construction career pathways for women, nonbinary, and underrepresented individuals in construction
Bay Area High Road Training Partnerships	Prepares workers for careers in electrification and building decarbonization
MCE and SEI's Green Construction Job Seekers Program	MCE, in partnership with SEI,[39] offers individualized career coaching, resume and interview support, and paid placements with local energy contractors to help launch careers in green trades like HVAC, plumbing, and electrical
Silicon Valley Clean Energy Contractor Training	Offers eligible Santa Clara County contractors $500 for completing an online course on all-electric building practices, plus up to $5,000 annually for installing electric appliances and promoting electrification technologies
Career Technical Education Foundation	Connects students, educators, and employers to build career-connected learning programs that prepare youth for life after high school, investing in regional pathways, internships, and education-to-workforce transitions; partners with Sonoma Clean Power

Power Sector

Current and Future State of the Workforce

The power sector currently employs roughly 41,000 workers in the BARCAP region.[40] Statewide employment in the power sector is projected to grow by more than 1.6 million jobs by 2045,[41] driven by the deployment of large-scale renewables, storage, and distributed generation. This employment forecast is based on the estimated investment and workforce needed to fully decarbonize California by 2045, assuming full electrification of the economy and wide integration of optimized and distributed solar and storage, along with utility-scale generation. Within the BARCAP region, this translates to an estimated demand of around 74,500 total full-time equivalent (FTE) workers in the sector by 2045. This scenario, however, may be more aggressive than BARCAP measure P-1 depending on where the new generation and storage referenced in the study is sited. Measure P-2, which expands customer programs equitably, may drive additional employment among electricity providers as they roll out new programs and increase capacity of existing programs. Further new employment opportunities may result from P-2 actions to deploy more power system and grid technologies like clean back up power, demand flexibility solutions, grid enhancing technologies, etc.

Much of this growth will involve equipping existing workers with new skills—such as electricians gaining expertise in grid modernization technologies, the integration of distributed energy resources (including household battery storage) into virtual power plants, and installation of vehicle charging infrastructure and batteries. The ongoing operations and maintenance of these systems will also employ a growing workforce. These emerging areas represent a notable evolution of traditional roles, underscoring the need for continuous upskilling and adaptation, but not necessitating a drastic overhaul of existing training and educational programming.

Currently, the BARCAP region has several refineries that employ around 3,250 direct fossil fuel workers,[42] mostly within the petroleum refinery industry of Contra Costa County, where the petroleum industry has historically been critical to the economy, offering high-paying jobs to local workers. When including other sectors reliant on refineries (e.g., construction, transportation), approximately 18,000 workers support this industry.[43] Workers who are displaced by refinery closures will need comprehensive reskilling and upskilling programs to help them transition into the renewable energy sector.

The power sector tends to be heavily unionized, as trades workers within utilities tend to be union members. However, as distributed energy resources continue to make up a larger share of the sector, union representation may decline. Implementing labor standards within publicly funded projects may help ensure that job quality remains high within this sector.

Occupational Analysis

Critical occupations in this sector include Electrical, Electronic, and Electromechanical Equipment Assemblers, Except Coil Winders, Tapers, and Finishers; Electrical Engineers; Electrical Power-Line Installers and Repairers; Solar Photovoltaic Installers; Power Plant Operators; and Wind Turbine Service Technicians. These occupations together make up a small portion of the overall Bay Area workforce but expanding them will be critical to successful implementation of the BARCAP measures. Some of these occupations are less concentrated in the Bay Area region than the nationwide economy, likely due to the Bay Area's largely urban setting and multifaceted economy. However, specific clean energy roles, such as Solar Photovoltaic Installers and Wind Turbine Service Technicians, are forecasted to grow considerably in the region over the next decade.

Geothermal energy, which might play a role in the BARCAP measures, requires many different occupations across different phases. These include scientific roles (e.g., Geologists, Hydrologists, Environmental Scientists), engineering roles (e.g., Civil Engineers, Electrical Engineers, Environmental Engineers), drilling occupations (e.g., Derrick Operators, Roustabouts), construction occupations (e.g., Construction Laborers, Electricians, Carpenters), as well as Power Plant Operators to operate and monitor the geothermal plant itself. Workers in many of these occupations will be able to transfer their skills from other industries to geothermal projects.[44]

Electrical, Electronic, and Electromechanical Equipment Assemblers represent an important occupation in battery manufacturing in the region—along with Team Assemblers, Inspectors, Testers, Sorters, Samplers, and Weighers, and Laborers and Freight, Stock, and Material Movers, Hand—and will be central to the Jobs First Next-Generation Battery Innovation and Manufacturing Hub Activation Plan, which emphasizes building a skilled, equitable workforce to advance battery production and supply chains.[45] Strengthening training pipelines for these workers will help position the region for success in battery manufacturing.

Many of the priority occupations in the power sector not only pay wages above the regional median but are also considered "living wages" in the Bay Area for single adults with no children. Electrical Engineers, Electrical Power-Line Installers and Repairers, and Power Plant Operators also offer family-sustaining wages for households with one working adult and two children.[46] As with other sectors throughout this memo, wages and the broader quality of jobs are contingent upon several factors, including geography, seniority, and unionization. While unionization tends to be higher in some industries within the power sector—such as utilities—unionization is much lower in other industries, such as the installation of solar PV panels. While some projects—especially those subject to prevailing wages or project labor agreement stipulations—may have unionized workers installing panels, other projects like rooftop installations often rely on a mobile workforce that receives relatively lower pay and fewer benefits and often does not live in the regions where they build projects.[47]

Table 7: BARCAP Region Power Sector Occupations

Occupation	Total Employment[48]	Employment Percent Change (2022-2032)[49]	Location Quotient[50]	Median Hourly Wage[51]
Electrical, Electronic, and Electromechanical Equipment Assemblers, Except Coil Winders, Tapers, and Finishers	4,977	1.5	1.09	$27.16
Electrical Engineers	3,908	9.1	1.12	$79.63
Electrical Power-Line Installers and Repairers	1,091	6.4	0.47	$59.54
Solar Photovoltaic Installers	1,023	45.7	1.77	$34.60
Power Plant Operators	196	-13.0	0.35	$58.09
Wind Turbine Service Technicians	88	9.4	0.35	$42.83

The transition to renewable energy sources requires both an expanded and highly skilled workforce. Building out training pipelines in battery storage, solar, wind, geothermal, and grid technologies, expanding apprenticeships, and ensuring equitable access to these opportunities will be essential. Occupations including Electrical Equipment Assemblers, Electrical Power-Line Installers and Repairers, and Power Plant Operators offer feasible career entry points, requiring a high school diploma and on-the-job (OTJ) training or an apprenticeship.

Table 8: Power Sector Occupational Education & Training Analysis[52]

Occupation	Role Within Sector	Minimum Education Requirement	Minimum Training Requirement	State License Requirement	Other Common Credentials
Electrical, Electronic, and Electromechanical Equipment Assemblers, Except Coil Winders, Tapers, and Finishers	Assemble or modify battery storage system equipment	High school diploma or equivalent	Up to one year OTJ training	Depends on type of electrical work being performed	Electronic Technicians Association (ETA) International

Electrical Engineers	Develop electrical systems and infrastructure for power generation, transmission, distribution, and battery storage	Bachelor's degree	Several years OTJ training	N/A	National Council of Examiners for Engineering and Surveying (NCEES) electrical exam
Electrical Power-Line Installers and Repairers	Install and maintain power lines that transmit electricity	High school diploma or equivalent	Up to one year OTJ training; recognized apprenticeship	N/A	Electronic Technicians Association (ETA) International
Solar Photovoltaic Installers	Install solar panel systems	Post-secondary certificate	Up to one year OTJ training; recognized apprenticeship	State Solar Contractor License	ETA International; North American Board of Certified Energy Practitioners
Power Plant Operators	Operate and monitor equipment that generates electricity in power plants	High school diploma or equivalent	Up to one year OTJ training	N/A	American Public Power Association certifications; North American Electric Reliability Corporation certifications
Wind Turbine Service Technicians	Maintain and repair wind turbines for wind power	Post-secondary certificate	One to two years OTJ training; potential apprenticeship	N/A	ETA International; North American Board of Certified Energy Practitioners

Ecosystem of Key Stakeholders and Programs

There are a range of stakeholders in the region that can lead and play a role in workforce development within the power sector. These include retail electricity providers (such as PG&E, public utilities, and Community Choice Aggregators) and BayREN, the region's Renewable Energy Network. Table 9 highlights some key organizations and initiatives. See the appendices to this document—Appendix B: Ecosystem of Initiatives Across BARCAP Sectors and Appendix D: References —for initiatives and efforts that apply to all five sectors and links to programs, respectively.

Table 9: Bay Area Key Organizations and Initiatives in the Power Sector[53]

Organization / Initiative / Program	Description

PG&E PowerPathway	Utility-led pre-apprenticeship program preparing workers for skilled utility careers
Bay Area High-Road Manufacturing Initiative - Working Partnerships USA	Regional effort to build a sustainable, equitable manufacturing ecosystem focused on battery storage and renewable energy technologies; includes pilot projects to improve job quality, support high-road employer practices, and develop a green industrial campus in Contra Costa County
GRID Alternatives	Nonprofit offering hands-on solar installation training and workforce entry programs in renewable energy
California Community Choice Association (CalCCA)	Advances workforce opportunities in renewable energy procurement and local energy projects
San Francisco Public Utilities Commission (SFPUC) Apprenticeships and Work Experience Programs	Provides career opportunities and training to residents from local communities to earn a salary while learning the skills necessary for high demand careers
The Energy Skills Collaborative (TESC)	Increases participation in the advanced energy economy and workforce in communities where health and financial well-being are most impacted by environmental distress
Bay Area E-Contractor Academy - Emerald Cities Collaborative	Multi-week workshop series for small, minority-/women-/veteran-owned contractors to build technical, business, and operational capacity in electrification, energy efficiency, renewable energy, and green retrofit construction
Bay Area Regional Energy Network (BayREN)	Regional network that provides contractor training, education, and workforce forums to support energy efficiency; offer training courses[54] in solar PV and storage systems, heat pumps, HVAC systems, energy code permitting and compliance, zoning codes, and sustainable home real estate
SunWork Volunteer Training Program	Trains individuals in solar basics and safety, then engages them in hands-on solar installations with professional staff; provides first step towards career in this field
College of San Mateo Electrical Power Systems Certificate	Three-semester certificate training program developed with PG&E and other utilities to prepare students for high-wage technical careers in industries like energy, transportation, and manufacturing, with training in electronics and instrumentation calibration
Contra Costa Harnessing Change: Refinery Transition Partnership (CCRTP)	Brings together refinery workers and community stakeholders to plan for equitable economic transition as Contra Costa shifts from oil refining to low-carbon industries

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Waste and Materials Sector

Current and Future State of the Workforce

The waste and materials workforce is fundamental to meeting California's waste diversion goals. Roughly 9,000 workers[55] are currently employed in the region's recycling, composting, and waste management fields. An additional 1,415 workers are employed in manufacturing jobs that are part of the supply chains relevant to materials management (glass, paper, metal, wood, etc.), such as consumer products and building materials manufacturing, and an additional 24,448 workers are employed in food processing jobs, which involves transforming agricultural products and surplus food into new products for intermediate or final consumption.[56] These workers will be essential in advancing the state's goals of waste diversion, recycling, and the circular materials economy, including actions like those detailed in Senate Bill (SB) 54 (2022).[57]

To achieve California's waste reduction goals, Bay Area employment is projected to add over 16,000 direct recycling-related jobs that are sustained on an annual basis.[58] [59] These forward-looking employment estimates are drawn from the "Putting California on the High Road: A Jobs and Climate Action Plan for 2030" report chapter on waste, highlighting the anticipated workforce impacts of food diversion and composting (BARCAP measures W-1), while the job impacts of methane reduction from waste management facilities (W-3) may be more diffuse. Much of the research around embodied carbon and low-carbon building materials (Measure W-2) does not capture workforce impacts, though some reports mention the need to upskill existing workers on new technologies and materials.[60] [61] This remains an area where more quantitative research could be conducted.

These projected job figures are rooted in California's expansion of recycling, composting, and related services, which create not only more jobs in the traditional waste removal field but also more science and data-driven work, such as tracking waste streams and managing records,[62] improving material recovery facility operations, and advancing innovative circular economy practices.[63] Importantly, this growth represents a new addition of jobs—expanding waste collection, recycling, and circular economies—primarily building on existing activities without displacing workers.

Occupational Analysis

Multiple core occupations will play a central role in anchoring green initiatives involved in discarding food, goods, and building materials in the region. Many of these occupations—including Operating Engineers; Heavy and Tractor-Trailer Truck Drivers; Shipping, Receiving, and Inventory Clerks, and Mobile Heavy Equipment Mechanics—have a smaller concentration of workers in the region than in the overall nationwide economy. Multiple priority occupations within the sector offer wages above the regional median and provide accessible entry points, often without requiring college degrees.

Table *10*: BARCAP Region Waste & Materials Sector Occupations

Occupation	Total Employment[64]	Employment Percent Change (2022-2032)[65]	Location Quotient[66]	Median Hourly Wage[67]
Heavy-Duty and Tractor-Trailer Truck Drivers	26,746	9.6	0.67	$31.48
Light-Duty Truck Drivers	20,310	10.8	1.05	$24.60
Shipping, Receiving, and Inventory Clerks	12.893	-7.5	0.83	$24.19
Operating Engineers and Other Construction Equipment Operators	6,321	8.0	0.72	$54.98
Mobile Heavy Equipment Mechanics, Except Engines	2,786	8.5	0.8	$44.21
Refuse and Recyclable Material Collectors	2,737	9.9	1.02	$34.89
Hazardous Materials Removal Workers	1,425	7.6	1.55	$30.13

Scaling this workforce will require sustained investment in training and credentialing, including commercial driver's licenses (CDL), OSHA certifications, and industry-recognized safety credentials. By equipping workers with the necessary skills to successfully perform these jobs, the region can expand waste diversion services, improve community health, and advance climate goals.

Table *11*: Waste & Materials Sector Occupational Education & Training Analysis[68]

Occupation	Role Within Sector	Minimum Education Requirement	Minimum Training Requirement	State License Requirements	Other Common Credentials
Heavy-Duty and Tractor-Trailer Truck Drivers	Drive waste/garbage trucks	High school diploma or equivalent	Up to one year OTJ training; potential apprenticeship	Class A or B Commercial driver's license (CDL)	N/A
Light-Duty Truck Drivers	Transportation of recovered food locally	High school diploma or equivalent	Up to one year OTJ training	Class C driver's license, Potentially Class A or B commercial	N/A

				driver's license (CDL)	
Shipping, Receiving, and Inventory Clerks	Track food recovery inventory and manage intake/ distribution	High school diploma or equivalent	Up to one year OTJ training	N/A	N/A
Operating Engineers and Other Construction Equipment Operators	Operate machinery on landfill sites and operate machinery essential in the deconstruction and dismantlement of buildings	High school diploma or equivalent	Up to one year OTJ training; recognized apprenticeship	N/A	Forklift Operator certification; Certified Equipment Manager
Mobile Heavy Equipment Mechanics, Except Engines	Maintenance of landfill machinery	Post-secondary certificate	One to two years OTJ training; recognized apprenticeship	N/A	National Center for Construction Education and Research (NCCER)[69] certifications; International Union of Operating Engineers (IUOE) Heavy Construction Equipment Mechanic
Refuse and Recyclable Material Collectors	Collect organic waste and recyclables, frontline landfill diversion, and support diverting construction waste from landfills by collecting recyclable and reusable building materials	High school diploma or equivalent	Up to one year OTJ training	N/A	Solid Waste Association of America certifications
Hazardous Materials Removal Workers	Handle and dispose of materials that pose environmental risks and safely remove and dispose of toxic materials during	High school diploma or equivalent	One to two years OTJ training; potential apprenticeship	OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER)	N/A

	building deconstruction, enabling reuse of materials				

Ecosystem of Key Stakeholders and Programs

Many organizations and initiatives already exist in the Bay Area that relate to waste and materials management, including workforce training programs in recycling and composting. However, there is opportunity for the creation of more intentional occupation-specific training programs and sector partnerships to build out the most robust workforce possible. Table 15 highlights key initiatives within the sector. See the appendices to this document—Appendix B: Ecosystem of Initiatives Across BARCAP Sectors and Appendix D: References —for initiatives and efforts that apply to all five sectors and links to programs, respectively.

Table *12*: Bay Area Key Organizations and Initiatives in the Waste Sector[70]

Organization / Initiative / Program	Description
Regenerative Jobs Program - Greenbelt Alliance	Workforce program linking diversion, composting, and regenerative agriculture with green job training
Civicorps	Offers training and employment in recycling and zero-waste services alongside educational support
Conservation Corps North Bay	Engages members in recycling, composting, and land restoration work while providing workforce development
Local and Regional Agencies Leading Recycling and Resource Efficiency	Includes organizations like StopWaste,[71] which is Alameda County's agency that serves as the Bay Area's lead organization on recycling and resource/water efficiency
California Climate Action Corps (CCAC) Fellowship	Deploys fellows statewide to lead community climate-action projects in urban greening, waste recovery, and wildfire resilience while gaining professional skills and certifications
Community Composting for Green Spaces – California Alliance for Community Composting	Supports the creation and expansion of community-scale composting sites statewide, providing job training, local food access, and green-space improvements in underserved communities
Gardening and Composting Educator Training Program (Get Up!)	Training course in the Bay Area that teaches sustainable gardening, regenerative composting practices, and ecological justice

Natural and Working Lands Sector

Current and Future State of the Workforce

The natural and working lands (NWL) sector currently employs about 49,000 people[72] in the BARCAP region, supporting nature-based carbon sequestration, wildfire mitigation, and ecological and agricultural restoration efforts. An estimated 2,200 more workers[73] [74] will be required in 2045 to meet the region's goals, based on the regional portion of the projected statewide NWL employment to implement California Air Resources Board's (CARB) 2022 Scoping Plan.[75] The four NWL measures within the BARCAP generally reflect actions within CARB's 2022 Scoping Plan, including improvement, management, and restoration of agricultural and working lands, expanding urban green spaces, wildfire management, and improved data analytics for nature-based solutions. The workforce in this sector will be key to implementing nature- and land-based climate solutions, including wildfire management, climate-beneficial agriculture, and urban greening.

While there are few "novel" occupational roles in this space, a growing emphasis on measuring and quantifying carbon capture in soils and landscapes represents an important scientific frontier for the sector that will require workers to continually grow their knowledge base. In addition, policies such as California's Sustainable Groundwater Management Act (SGMA) create new opportunities to transform farmland into hubs of climate resilience and ecological restoration. This transition does not represent a wholesale loss of existing activities but rather an evolution of practices that modify some existing tasks for workers. Agricultural work will increasingly shift toward lower-carbon, climate beneficial farming methods, prioritizing soil health and reducing excess nitrogen and phosphate inputs, highlighting the need for a workforce capable of managing land in ways that align with changing policies, priorities, and technologies. Fire and fuel management will include prescribed burning, targeted grazing, and other emergent sustainable practices. Urban greening—which includes planning and maintaining new foliage and greenery in urban areas to provide shade, mitigate heat island effects, and improve air quality—also plays an important role within the BARCAP through NWL Measure 4.

Occupational Analysis

Key occupations in this sector include Tree Trimmers and Pruners (Arborists), Firefighters,[76] Conservation Scientists, Foresters, and Agricultural Engineers, among others. Workers in the NWL sector are integral to protecting ecosystems, managing land sustainably, and preparing the region for climate resilience, yet some of these occupations—Farmers, Ranchers, and Other Agricultural Managers; Foresters; and Forest Fire Inspectors and Prevention Specialists—remain somewhat scarce in the region, with lower-than-average concentrations of workers compared to nationally. While several factors may contribute to these lower concentrations, the Bay Area's predominantly urban landscape likely explains much of the disparity, as these professions tend to be more prevalent in rural regions across the country.

Arborists will remain a crucial resource in urban greening and tree maintenance; however, as local budgets tighten and consolidate, cities and counties may lack the staff to maintain existing green spaces. Contracting arborist and urban greening work across multiple cities and counties may induce cost savings efficiencies while distributing costs across multiple jurisdictions.[77]

Another critical part of the NWL workforce is workers involved in climate beneficial agriculture. Occupations that support this industry in California include Farmworkers and Laborers, Crop, Nursery, and Greenhouse; Farmworkers, Farm, Ranch, and Aquacultural Animals; Agricultural Equipment Operators; First-line Supervisors of Farming, Fishing, and Forestry Workers; Graders and Sorters, Agricultural Products; and Farm Equipment Mechanics and Service Technicians. These workers will all play a vital role in whole-farm Climate Smart Agriculture projects.[78]

Professional services industry workers that provide supportive services to the NWL efforts will also play an important role in BARCAP measures, such as Business Operations Specialists[79] and Urban and Regional Planners. These workers offer expert planning, design, analysis, research, and implementation for conservation and restoration projects, ensuring the success of such projects through science-based solutions and collaborative efforts.

Many occupations within the NWL sector provide wages above the regional median of $33.93/hour. Many of these occupations also offer "living wages" in the Bay Area for single adults with no children as well as family-sustaining for households with two working adults and two children,[80] reinforcing their potential to provide meaningful livelihood while advancing public good.

Table *13*: BARCAP Region Natural & Working Lands Sector Occupations

Occupation	Total Employment[81]	Employment Percent Change (2022-2032)[82]	Location Quotient[83]	Median Hourly Wage[84]
Farmworkers and Laborers Crop, Nursery, and Greenhouse	11,042	1.7	1.13	$21.84
Firefighters[85]	4,158	6.8	0.72	$56.68
Farmers, Ranchers, and Other Agricultural Managers	3,923	0.4	0.29	$57.91
Environmental Scientists and Specialists	2,079	9.7	1.37	$53.93
Tree Trimmers and Pruners	1,215	11.9	1.05	$36.98
Urban and Regional Planners[86]	1,135	8.1	1.46	$63.38

Forest and Conservation Technicians	889	2.9	1.47	$34.17
Conservation Scientists[87]	436	15.0	0.92	$47.12
Foresters	142	0.0	0.67	$56.61
Agricultural Engineers[88]	43	10.2	1.4	$54.25
Forest Fire Inspectors and Prevention Specialists	39	6.8	0.65	$58.02

Developing a prepared and capable NWL workforce requires targeted investment in education and applied training. Technical roles such as Farmers, Ranchers, and Other Agricultural Managers, Environmental Scientists and Specialists, Urban and Regional Planners, Conservation Scientists, Foresters, and Agricultural Engineers typically require a bachelor's degree and several years of field experience. Meanwhile, other roles, such as Farmworkers and Laborers Crop, Nursery, and Greenhouse and Tree Trimmers and Pruners, offer viable entry-level career pathways with on-the-job (OTJ) training and less education requirements. Integrating climate resilience into higher education, strengthening applied training opportunities that bridge classroom learning with real-world application, and building clear career ladders will help ensure the region has the expertise to restore ecosystems and safeguard communities.

Table *14*: Natural & Working Lands Sector Occupational Education & Training Analysis[89]

Occupation	Role Within Sector	Minimum Education Requirement	Minimum Training Requiremen	State License Requirements	Other Common Credentials
Farmworkers and Laborers Crop, Nursery, and Greenhouse	Cultivate crops, maintain green spaces, and implement conservation practices on working lands	Less than high school diploma	Few months OTJ training	N/A	N/A
Firefighters[90]	Protect natural lands from wildfire threats	High school diploma or equivalent	One to two years OTJ training	EMT Certification; Candidate Physical Ability Test (CPAT); specific requirements vary by department	N/A

Farmers, Ranchers, and Other Agricultural Managers	Manage regenerative farming, soil conservation, and agricultural practices	Bachelor's degree	Several years OTJ training	Farm Labor Contractor (FLC) license (depending on job circumstances)	Certified Rangeland Manager (CRM)[91]
Environmental Scientists and Specialists	Analyze environmental impacts and develop strategies to enhance ecosystem health across rural and urban landscapes	Bachelor's degree	Several years OTJ training	Registered Environmental Health Specialist (REHS)[92]	National Registry of Environmental Professionals certifications
Tree Trimmers and Pruners	Maintain green infrastructure and treat urban green spaces	Less than high school diploma	Up to a year OTJ training	N/A	International Society of Arboriculture (ISA)[93]
Urban and Regional Planners	Design land use strategies that integrate green spaces	Master's degree	Some potential OTJ training, but assumed workers already have the training	N/A	Certified Urban Planner[94] or Certified Planner[95]
Forest and Conservation Technicians	Assist in monitoring and maintaining natural resources and compile data on forest characteristics	High school diploma or equivalent or associate's degree	One to two years OTJ training	Certified Rangeland Manager (CRM)[96]	N/A
Conservation Scientists	Develop and oversee land management plans that protect natural resources	Bachelor's degree	Several years OTJ training	N/A	N/A
Foresters	Manage forested lands for conservation and wildfire prevention	Bachelor's degree	Several years OTJ training	Registered Professional Forester license[97]	N/A
Agricultural Engineers	Develop technical systems for sustainable farming and land use	Bachelor's degree	Several years OTJ training	Professional Engineer (PE) license[98]	N/A

Forest Fire Inspectors and Prevention Specialists	Assess fire hazards, reduce severity of fires, and maintain forest health and stability	High school diploma or equivalent	One to two years OTJ training	CA State Fire Training (SFT) certification program	N/A

Ecosystem of Key Stakeholders and Programs

Different counties and municipalities throughout the region may have different priorities within the NWL sector. Cities may prioritize urban greening, while counties with substantial rural and fire-prone terrain may prioritize fire risk mitigation activities. Both independent and collaborative efforts are important and will require different mechanisms. One example of local action is Sonoma County's designation as a "Climate Resiliency District," or CRD—the only county in the state to have such a designation.[99] The Sonoma CRD demonstrates how coordinated, cross-jurisdictional strategies can generate meaningful impacts, and the frameworks developed in one jurisdiction can be adapted and replicated elsewhere to extend the impact of these efforts across numerous communities. This model also reflects how the region can address funding gaps and identify steady revenue streams for climate-related projects that are specific to their particular needs.

Other initiatives involved in the NWL sector include training efforts for carbon farm planners and carbon farmers with increased agroecological knowledge. Resource Conservation Districts' (RCD) "Regional Carbon Farming Hubs" are working with university partners, state agencies, and other conservation organizations to expand carbon farming education and training; they have set a minimum target of 42 RCD-related staff trained annually. Other efforts occurring across the Bay Area are outlined below.

Table 6 highlights some key organizations and initiatives. See the appendices to this document—Appendix B: Ecosystem of Initiatives Across BARCAP Sectors and Appendix D: References —for initiatives and efforts that apply to all five sectors and links to programs, respectively.

Table *15*: Bay Area Key Organizations and Initiatives in the Natural & Working Lands Sector[100]

Organization / Initiative / Program	Description
Indigenous and Immigrant Farm Workers Building a Climate Resilience Workforce - North Bay Jobs with Justice	Trains farm workers in climate-smart agricultural practices and resilience strategies
Regenerative Jobs Program	Creates workforce opportunities in regenerative agriculture and sustainable land management
Civicorps	Provides training and paid work experience in land management for young adults
Friends of the Urban Forest	San Francisco nonprofit offering hands-on training in tree planting, urban forestry, and nursery management

Conservation Corps North Bay	Provides young adults with paid work in habitat restoration, wildfire fuel reduction, and environmental stewardship
Providing High-Road Jobs to Latin Women Serving Their Community - UpValley Family Centers of Napa County	Develops a worker cooperative for Latina *promotoras* in Napa County, who serve disadvantaged populations, including farmworkers, and act as frontline emergency and disaster response workers in climate-impacted communities
Agricultural Worker Training and Advancement with High Road Employers (Ag HiRE)	Creates a bilingual training pipeline for Spanish-speaking farmworkers to advance into higher-paying jobs
Bay Area Farmer-to-Farmer Training (BAFFT) - Agroecology Commons	A nine-month agroecology program offering hands-on small-farm production, food sovereignty, and environmental justice training across the Bay Area
Farmer Mobilization Apprenticeships and Mentorship – Agroecology Commons	Provides paid apprenticeships connecting BAFFT graduates with experienced agroecological farmers to deepen skills and foster food-sovereignty projects
California Conservation Corps Training and Workforce Development Program	Enrolls young adults in year-long service projects that deliver forest fuel reduction, habitat restoration, and energy-efficiency work while preparing them for green careers
Environmental Management Social Enterprise - Civicorps	Engages Bay Area individuals in paid critical conservation work that builds environmental stewardship and job readiness
California Climate Action Corps (CCAC) Fellowship	Deploys fellows statewide to lead community climate-action projects in urban greening, waste recovery, and wildfire resilience while gaining professional skills and certifications
California Water, Wastewater, and Energy Workforce Development Program - Municipal Utilities Association	Builds a diverse, equitable workforce pipeline for underrepresented populations to secure stable careers in California's water, wastewater, and public energy utilities sectors
CAL FIRE Training Centers	Four training centers across California with core learning spaces providing realistic operational environments
Las Positas College East Bay Regional Fire Academy	Training and education provider for careers as certified firefighters by a professional fire service agency
Chabot College Fire Technology Program	One of the longest running fire programs in the Bay Area; offers coursework leading to industry certifications
City College of San Francisco Fire Academy	Course eligible to CCSF students, taught under the certification of the California State Fire Marshal Office of State Fire Training
South Bay Fire Fighter 1 & 2 Academy	Operated by the South Bay Regional Public Safety Training Consortium, an accredited regional training program (ARTP) with state fire training (SFT)
Center for Land-Based Learning California Farm Academy	Registered apprenticeship combining paid on-the-job training and instruction to elevate farmworkers to farm or ranch manager roles

Farm and Land Steward Apprenticeship Program – San Francisco Zen Center	Seasonal apprenticeship for farm or land stewardship roles on the organic farm and gardens at Green Gulch
Alemany Farm Internships	Interns work alongside Alemany Farm managers growing food and maintaining the organic farm dedicated to food security and community education
Regenerative Agriculture Farm Training (RAFT) - California Native Garden Foundation (CNGF)	15-week course to teach students how to manage regenerative organic agriculture methods
University of California Cooperative Extension	Connects University of California research and expertise with local residents, offering programs in food and nutrition, youth development, gardening and pest management, and natural resources to improve community health, the environment, and local economy
California Resource Conservation Districts (RCDs)	Provides leadership in conserving natural resources, preserving wildlife and habitat, training land stewards, and supporting sustainable agriculture through education, outreach, technical assistance, and partnerships
Santa Rosa Junior College Sustainable Agriculture Program	Offers an Associate of Science degree and two certificates focused on organic farming, ecological land management, and direct marketing to prepare for careers in Sonoma County's agricultural sector

Frontline Communities

Employment demand created through BARCAP measures can also offer substantial opportunity for individuals from frontline communities. Over 1.9 million residents in the region live within areas identified as frontline communities. The labor force participation rates for both frontline and non-frontline communities are around 66%—although the unemployment rate for frontline communities is nearly two percentage points higher than non-frontline communities. Job seekers residing in these frontline communities may also require additional resources, such as childcare, transportation assistance, and other services to overcome the systemic barriers to participating in certification and training programs and secure high road employment.

Table *16*: Employment and Labor Force Data by Community

	Population	Employment	Unemployment Rate	Labor Force Participation Rate	Median Family Income
Non-Frontline	3,815,995	1,989,720	4.81%	66.36%	$160,548
Frontline	1,910,134	974,520	6.65%	66.39%	$112,046

Job Quality and Accessibility

Nearly three-quarters (19 of the 26) of the priority occupations highlighted throughout this workforce study do not require college degrees for entry into the field, and they also provide livable wages, which means that not only are these roles accessible for individuals in frontline communities who may not have a college degree, but these jobs also provide an entry point into sustainable pathways to greater wealth and income levels.

While these occupations are technically accessible based on educational requirements and provide higher quality given wages, this does not mean that people in frontline communities will be able to access these roles in the absence of additional policy or support. For example, job seekers from frontline communities may be aware of these opportunities, but may lack access to childcare, accessible last mile transit options, or have other barriers beyond education.

Many of the measures in the BARCAP identify these needs and provide support to address these challenges. Initiatives beyond the BARCAP, such as California Jobs First, also offer funding streams to improve access to these opportunities. However, additional funding and organizational structures to support these initiatives will be important to ensure job seekers in frontline communities have access to the employment opportunities generated through the BARCAP.

Community Engagement Workforce

In addition to the professional services, skilled trades, and other types of jobs that will be crucial to implementing the measures in the BARCAP, there is also an important community engagement component of the BARCAP measures that offers jobs beyond the priority occupations already listed. Many BARCAP measures involve engaging residents, business owners, and communities, and sharing information about new technologies and opportunities. These community engagement roles will also be crucial for informing and recruiting jobs seekers, empowering them to receive the necessary certification and training, and connecting them with relevant employment opportunities that the BARCAP presents, so that job seekers from frontline communities can have the opportunity of working to make their communities less polluted and more climate resilient while also securing employment in good-paying jobs.

Furthermore, many of the BARCAP measures identify engagement specifically with frontline communities. After decades of disinvestment and disenfranchisement, these communities may be skeptical of new opportunities or technologies, though having informed and trusted advisors within their own communities that encourage participation in these opportunities or technologies may help alleviate these concerns. Therefore, educating and training individuals to support building electrification programs or provide information on rebate programs and education opportunities or waste collection initiatives –while paying them living wages – will be a central component of successful implementation.

Table *17*: BARCAP Region Non-Profit and Community Organization Occupations

Occupation	Total Employment[101]	Employment Percent Change (2022-2032)[102]	Location Quotient[103]	Median Hourly Wage[104]
Social and Community Service Managers	5,478	15.7	1.4	$44.50
Community and Social Service Specialists	2,589	8.9	1.33	$33.02
Environmental Scientists and Specialists	2,079	9.7	1.37	$53.93

Many jobs exist within the community organization sector, and the ones highlighted in the table below are only a small sample of opportunities available to individuals. While some positions may prefer undergraduate or advanced degrees or more extensive experience, the field also offers numerous accessible entry points. Individuals can begin their careers through part-time roles, coordinator-level roles, or support and assistance roles that typically require less formal education and training yet still provide valuable experience and pathways for growth.

Table *18*: Non-Profit and Community Organization Occupational Education & Training Analysis

Occupation	Role Within Sector	Minimum Education Requirement	Minimum Training Requirements/Preferences
Social and Community Service Managers	Manage green initiative programs and coordinate food recovery programs/community environmental health outreach	Bachelor's degree	Several years OTJ training
Community and Social Service Specialists	Build relationships with local communities, educate on green initiatives, and mobilize participation in programs	Associate's or Bachelor's degree	Several years OTJ training
Environmental Scientists and Specialists	Work within non-profits to address disproportionate environmental burdens, advocate for policy change, and support community-led solutions	Bachelor's degree	Several years OTJ training

Recommendations and Strategies to Meet Workforce Needs

This section outlines a series of recommendations to help ensure that the BARCAP region can meet a range of workforce needs across the five sectors. While some solutions may be more applicable to certain sectors than others, the full suite of recommendations will help address workforce challenges across all five sectors.

1. **Coordinate across unions, community colleges, vocational and technical schools, private sector, workforce development boards, and non-profit training organizations.** Most sectors have at least a few training providers that provide clear examples of the types of curricula, training support, and connection to employer networks that are necessary to meet workforce needs and support job seekers within frontline communities. For example, in the building sector the partnership between the Rising Sun Center for Opportunity and local trade unions provides a strong pipeline that encompasses everything from community outreach and engagement of job seekers within priority populations, training on modern technologies and support services along the way, and eventual connection and integration into the high road workforce through labor unions. AC Transit's Zero Emission Bus University program in partnership with Chabot College is another great example found within the transportation sector. Other sectors could benefit from identifying similar programmatic champions, implementing these systems throughout the Bay Area, and ensuring that training is accessible to priority populations.

2. **Increase communication and awareness of BARCAP careers within K-16 education.** A program that helps teach students about the in-demand careers outlined in the BARCAP and anticipated wages could help raise awareness of opportunities, guide students towards relevant coursework, and get them started early on career paths. The BARCAP can serve as a foundational document that demonstrates the wide range of initiatives already underway that promote job security and introduce job seekers to potential employers and training programs.

3. **Encourage and facilitate sustained and consistent funding for workforce development, which is a core component to perpetuating the activities of the BARCAP.** While there are some existing funding streams and initiatives that can be leveraged, a more consistent pool of funds could help support job creation and the training to help frontline communities secure those jobs. Regional coordination of funding, whether that be pooling of funds or 'earmarked' amounts within local agencies that fund similar 'archetypical' programs, could be one opportunity here. Sonoma County's classification as a Climate Resiliency District may also be a new avenue to raise and

utilize funds that are specifically geared towards addressing climate-related challenges, including the necessary workforce.

4. **Incentive program administrators can lead the way on encouraging job quality.** Existing job quality within a sector is driven primarily by market dynamics—how much cost will the market bear and what benefits does it perceive with greater job quality? The buildings sector is a great example of this phenomenon, where large scale projects often utilize unionized labor forces because those employers have access to a very large pool of highly trained and skilled talent, ensuring that job sites can scale quickly, are safer for workers, and result in high quality construction. However, smaller scale projects, such as those within single-family homes, often cannot bear the additional expense of such large and qualified teams. As a result, smaller scale employers or informal workers make up the majority of this market.[105] Local governments and agencies can intervene by requiring labor standards for publicly funded projects. Local agencies can also get inventive to circumvent some of these additional market factors. For example, the City of Berkeley's Just Transition Residential Electrification Pilot seeks to aggregate residential projects to make them more accessible and efficient for employers with high road employment practices. This system could work for other sectors, such as setting labor standards for waste processing centers or urban greening initiatives.

5. **Policymakers must continue to monitor the energy transition.** While most of the sectors within the BARCAP are likely to see additional employment needs without driving significant employment disruption, there are segments of the economy that will undergo change, and workers within these sectors may require assistance to transition to new roles. The region could start up an 'energy transition' working group that is responsible for tracking developments in technology and the workforce, proactively identifying areas where employment disruption may be occurring, and working with existing local workforce and economic development organizations to support workers facing disruption.

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[1] "California High-Road: A Road Map to Job Quality." UCLA Labor Center, (n.d.). https://cwdb.ca.gov/wp-content/uploads/sites/43/2020/08/OneSheet_Job-Quality_ACCESSIBLE.pdf

[2] "Workforce Impacts of Achieving Carbon-Neutral Transportation in California." UCLA Luskin Center for Innovation, 2022. https://innovation.luskin.ucla.edu/wp-content/uploads/2022/09/Workforce-Impacts-of-Achieving-Carbon-Neutral-Transportation-in-California.pdf

[3] "Driving California's Transportation Emissions to Zero." University of California Institute of Transportation Studies, 2021. https://escholarship.org/uc/item/3np3p2t0

[4] Includes direct, indirect, and induced workers. Estimate does not account for substantial decline in internal combustion engine vehicles (ICEVs) jobs or fossil fuel jobs between now and 2045.

[5] "Evaluating Benefits from Transportation Investments Aligned with the Climate Action Plan for Transportation Infrastructure (CAPTI)." San Jose State University Mineta Transportation Institute, 2023. https://transweb.sjsu.edu/sites/default/files/2227-Alexander-California-Climate-Action-Plan-Transportation-Infrastructure.pdf

[6] This employs a similar methodology to what was utilized in the Bay Area's Priority Climate Action Plan (https://www.baaqmd.gov/en/plans-and-climate/climate-planning/bay-area-regional-climate-action-planning-initiative/priority-climate-action-plan)

[7] "EVs Cost 40 Percent Less to Maintain Than Conventional Cars." Yale School of the Environment, 2021. https://e360.yale.edu/digest/energy-department-report-finds-that-evs-cost-40-percent-less-to-maintain-than-conventional-cars?

[8] "Fossil Fuel Layoff: The Economic and Employment Effects of a Refinery Closure on Workers in the Bay Area." UC Berkeley Labor Center, 2023. https://laborcenter.berkeley.edu/fossil-fuel-layoff/#:~:text=Targeted%2C%20individualized%20job%20search%20assistance,during%20layoffs%20and%20job%20transitions

[9] The "Retail Salespersons" occupational category spans many industries beyond automotive sales, and because most roles in those industries require limited training and are often part-time or seasonal, the overall median wage for the occupation skews lower than other more specific occupations identified in this memo.

[10] "Living Wage Calculation for San Francisco-Oakland-Berkeley, CA." MIT Living Wage Calculator, 2025. https://livingwage.mit.edu/metros/41860

[11] Data from JobsEQ. 2025Q1. Figures reflect total employment for each occupation across all industries and sectors, not limited to those directly associated with the BARCAP sector.

[12] Percent change in employment across the state of California. Data from Long-Term Occupational Employment Projections, California Open Data Portal (https://data.ca.gov/dataset/long-term-occupational-employment-projections/resource/274e273c-d18c-4d84-b8df-49b4d13c14ce)

[13] Location quotients (LQ) measure the concentration of an occupation in a local/regional area by comparing its share of employment to its share of national employment. An LQ greater than 1 means the occupation is more concentrated locally than nationally, while an LQ less than 1 indicates less concentration. Data from JobsEQ. 2025Q1.

[14] Data from JobsEQ. 2025Q1.

[15] O*NET OnLine, U.S. Department of Labor (https://www.onetonline.org/)

[16] Provided by CA Department of Motor Vehicles (DMV).

[17] This list is not exhaustive, and other key partners and funders in the space may be absent.

[18] "U.S. Energy and Employment Report." U.S. Department of Energy, 2024. https://www.energy.gov/media/330956

[19] "California Building Decarbonization Workforce Needs and Recommendations." UCLA Luskin Center for Innovation, 2019. https://innovation.luskin.ucla.edu/wp-content/uploads/2019/11/California_Building_Decarbonization.pdf

[20] "California Building Decarbonization Workforce Needs and Recommendations." UCLA Luskin Center for Innovation, 2019. https://innovation.luskin.ucla.edu/wp-content/uploads/2019/11/California_Building_Decarbonization.pdf

[21] "Identifying and Defining High Priority Commercial Building Energy Efficiency and Electrification Jobs and Skills for a Growing and Diverse Workforce." American Council for an Energy-Efficient Economy (ACEEE), 2024. https://www.aceee.org/sites/default/files/proceedings/ssb24/assets/attachments/20240722163107796_c092d835-2227-4c8b-8cd5-580adbb01746.pdf

[22] Data from JobsEQ. 2025Q1.

[23] The *federal poverty wage* reflects the minimum income needed to avoid poverty, but does not account for regional variations in cost of living or the actual expenses required to maintain a basic standard of living. For this analysis, we use the *living wage* designation to more accurately capture the income necessary for workers to meet essential needs, providing a more realistic benchmark for evaluating job quality.
[24] "Living Wage Calculation for San Francisco-Oakland-Berkeley, CA." MIT Living Wage Calculator, 2025. https://livingwage.mit.edu/metros/41860
[25] Data from JobsEQ. 2025Q1. Figure reflects total employment for each occupation across all industries and sectors, not limited to those directly associated with the BARCAP sector.
[26] Percent change in employment across the state of California. Data from Long-Term Occupational Employment Projections, California Open Data Portal (https://data.ca.gov/dataset/long-term-occupational-employment-projections/resource/274e273c-d18c-4d84-b8df-49b4d13c14ce)
[27] Location quotients (LQ) measure the concentration of an occupation in a local/regional area by comparing its share of employment to its share of national employment. An LQ greater than 1 means the occupation is more concentrated locally than nationally, while an LQ less than 1 indicates less concentration. Data from JobsEQ. 2025Q1.
[28] Data from JobsEQ. 2025Q1.
[29] "Bay Area Residential Building Decarb High Road Training Partnership Summary." Rising Sun Center for Opportunity, (n.d.). https://risingsunopp.org/wp-content/uploads/Rising-Sun-Bay-Area-Residential-Building-Decarb-HRTP-Summary.pdf
[30] O*NET OnLine, U.S. Department of Labor (https://www.onetonline.org/)
[31] OSHA certification verifies that a worker has completed training on workplace safety and health hazards.
[32] NCCER offers industry-recognized credentials across numerous skilled trades.
[33] Occupation defined in accordance with the nomenclature of the Standard Occupational Classification system used in federal labor statistics. Steamfitters may entail different job activities than Plumbers and Pipefitters in the building sector and may have different licensing and education requirements.
[34] EPA 608 certification is a federally mandated requirement for technicians who handle refrigerants in HVAC systems, ensuring compliance with environmental regulations.
[35] NATE certification is a nationally recognized credential for HVAC technicians that validates their skills in installing, maintaining, and troubleshooting HVAC systems.
[36] "Workforce Challenges for Zero Nox Requirements – Implementation Working Group Research." Bay Area Air District and BW Research, 2024. https://www.baaqmd.gov/~/media/files/community-health/building-appliance-implementation/workforce-summary-memo-pdf.pdf?rev=a8670756237f4fcdbc4e3b8603ff951b&sc_lang=en
[37] This list is not exhaustive, and other key partners and funders in the space may be absent.
[38] Events & Training, Bay Area Regional Energy Network. https://www.bayren.org/events-training?audience=All&type=Training&title=&protect_form_flood_control=protect_form_flood_control
[39] Energize Careers. https://www.energizecareers.org/participate.html
[40] "U.S. Energy and Employment Report." U.S. Department of Energy, 2024. https://www.energy.gov/media/330956
[41] "Role of Distributed Generation in Decarbonizing California by 2045." Vibrant Clean Energy, 2021. https://vibrantcleanenergy.com/wp-content/uploads/2021/07/VCE-CCSA_CA_Report.pdf#:~:text=The%20total%20full%20time%20equivalent,scale%20solar%20and%20storage%20by
[42] Quarterly Census of Employment and Wages (QCEW), California Open Data Portal. https://data.ca.gov/dataset/quarterly-census-of-employment-and-wages/resource/119eef38-3b59-499f-8f7c-9bea4768469d
[43] "Refining Transition: A Just Transition Economic Development Framework For Contra Costa County, California." UC Berkeley Labor Center, 2025.

[44] "Careers in Geothermal Energy." U.S. Bureau of Labor Statistics.
[45] "Next Generation Battery Innovation and Manufacturing Hub in the Bay Area: Activation Plan." Bay Area Jobs First Collaborative, 2025.
[46] "Living Wage Calculation for San Francisco-Oakland-Berkeley, CA." MIT Living Wage Calculator, 2025. https://livingwage.mit.edu/metros/41860
[47] "An Updated Review of the Solar PV Installation Workforce Literature" NREL 2023.
[48] Data from JobsEQ. 2025Q1. Figures reflect total employment for each occupation across all industries and sectors, not limited to those directly associated with the BARCAP sector.
[49] Percent change in employment across the state of California. Data from Long-Term Occupational Employment Projections, California Open Data Portal (https://data.ca.gov/dataset/long-term-occupational-employment-projections/resource/274e273c-d18c-4d84-b8df-49b4d13c14ce)
[50] Location quotients (LQ) measure the concentration of an occupation in a local/regional area by comparing its share of employment to its share of national employment. An LQ greater than 1 means the occupation is more concentrated locally than nationally, while an LQ less than 1 indicates less concentration. Data from JobsEQ. 2025Q1.
[51] Data from JobsEQ. 2025Q1.
[52] O*NET OnLine, U.S. Department of Labor (https://www.onetonline.org/)
[53] This list is not exhaustive, and other key partners and funders in the space may be absent.
[54] Events & Training, Bay Area Regional Energy Network. https://www.bayren.org/events-training?audience=All&type=Training&title=&protect_form_flood_control=protect_form_flood_control
[55] Occupational Employment and Wage Statistics (OEWS), U.S. Bureau of Labor Statistics. https://www.bls.gov/oes/
[56] Quarterly Census of Employment and Wages (QCEW), California Open Data Portal. https://data.ca.gov/dataset/quarterly-census-of-employment-and-wages/resource/119eef38-3b59-499f-8f7c-9bea4768469d
[57] "SB 54 Statewide Needs Assessment." CalRecycle, (n.d.). https://calrecycle.ca.gov/packaging/packaging-epr/needs-assessment/
[58] "Putting California on the High Road: A Jobs and Climate Action Plan for 2030." UC Berkeley Labor Center, 2020. https://laborcenter.berkeley.edu/wp-content/uploads/2020/08/Chapter-9-Waste-Sector-Putting-California-on-the-High-Road.pdf
[59] Estimate does not include indirect employment in equipment supply chains or manufacturing with recycled inputs, nor do they account for induced jobs created by the spending of newly employed workers. As a result, the full economic impact of this sector is likely greater than stated.
[60] "Embodied Carbon Reduction Roadmap." ARUP and Natural Resources Defense Council (NRDC), 2023. https://www.arup.com/en-us/insights/embodied-carbon-reduction-roadmap/
[61] "Reducing Embodied Carbon in Buildings." RMI, 2021. https://rmi.org/insight/reducing-embodied-carbon-in-buildings/
[62] California's SB 1383 requires entities to collect, maintain, and report data on waste stream tracking and contamination monitoring for compliance purposes, creating potential for jobs in data management and compliance. https://calrecycle.ca.gov/organics/slcp/recordkeeping/
[63] "Jobs and Skills in the Circular Economy: State of Play and Future Pathways." Circle Economy, 2020. https://cdn.prod.website-files.com/5d26d80e8836af2d12ed1269/5e6897dafe8092a5a678a16e_202003010%20-%20J%26S%20in%20the%20circular%20economy%20report%20-%20297x210.pdf
[64] Data from JobsEQ. 2025Q1. Figures reflect total employment for each occupation across all industries and sectors, not limited to those directly associated with the BARCAP sector.

[65] Percent change in employment across the state of California. Data from Long-Term Occupational Employment Projections, California Open Data Portal (https://data.ca.gov/dataset/long-term-occupational-employment-projections/resource/274e273c-d18c-4d84-b8df-49b4d13c14ce)
[66] Location quotients (LQ) measure the concentration of an occupation in a local/regional area by comparing its share of employment to its share of national employment. An LQ greater than 1 means the occupation is more concentrated locally than nationally, while an LQ less than 1 indicates less concentration. Data from JobsEQ. 2025Q1.
[67] Data from JobsEQ. 2025Q1.
[68] O*NET OnLine, U.S. Department of Labor (https://www.onetonline.org/)
[69] NCCER offers industry-recognized credentials across numerous skilled trades.
[70] This list is not exhaustive, and other key partners and funders in the space may be absent.
[71] StopWaste. https://www.stopwaste.org/
[72] Employment estimates for this sector were derived using California Open Data Portal's Quarterly Census of Employment and Wages (QCEW) data aligned with relevant NWL NAICS codes. These codes were selected based on the BARCAP definition of the NWL sector and informed by desktop research of California reports that assess land management industries and activities. Retrieved September 10, 2025. NAICS codes selected include: 111, 112, 112, 11511, 11521, 11531, 22131, 23799, 333111, 54162, 56173, 813312, 92512, 92613.
[73] "Scoping Plan for Achieving Carbon Neutrality." California Air Resources Board (CARB), 2022. https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents
[74] Includes direct, indirect, and induced employment. Figure represents a headcount of jobs in 2045 compared to a baseline scenario.
[75] "Scoping Plan for Achieving Carbon Neutrality." California Air Resources Board (CARB), 2022. https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents
[76] Occupation defined in accordance with the nomenclature of the Standard Occupational Classification system used in federal labor statistics. While this occupational category includes both urban and wildland firefighters, emphasis is placed on wildland firefighters due to their central role in NWL BARCAP measures.
[77] "Service Sharing: How Counties Do More with Less." National Association of Counties, 2017. https://www.naco.org/resources/service-sharing-1
[78] "Farmer and Rancher-Led Climate Change Solutions." California Department of Food and Agriculture, 2021. https://www.cdfa.ca.gov/oefi/climate/docs/cdfa_farmer_and_rancher-led_climate_solutions_meetings_summary.pdf
[79] Titles for this role also include Sustainability Consultant, Energy Strategic Advisor, Sustainable Design Coordinator.
[80] "Living Wage Calculation for San Francisco-Oakland-Berkeley, CA." MIT Living Wage Calculator, 2025. https://livingwage.mit.edu/metros/41860
[81] Data from JobsEQ. 2025Q1. Figures reflect total employment for each occupation across all industries and sectors, not limited to those directly associated with the BARCAP sector.
[82] Percent change in employment across the state of California. Data from Long-Term Occupational Employment Projections, California Open Data Portal (https://data.ca.gov/dataset/long-term-occupational-employment-projections/resource/274e273c-d18c-4d84-b8df-49b4d13c14ce)
[83] Location quotients (LQ) measure the concentration of an occupation in a local/regional area by comparing its share of employment to its share of national employment. An LQ greater than 1 means the occupation is more concentrated locally than nationally, while an LQ less than 1 indicates less concentration. Data from JobsEQ. 2025Q1.
[84] Data from JobsEQ. 2025Q1.

[85] Occupation defined in accordance with the nomenclature of the Standard Occupational Classification system used in federal labor statistics. While this occupational category includes both urban and wildland firefighters, emphasis is placed on wildland firefighters due to their central role in NWL BARCAP measures.
[86] Includes Urban Forestry Planners. Can include planners employed at Resource Conservation Districts.
[87] Includes roles involved in wildfire GIS analysis and environmental analysts. Can include scientists employed at Resource Conservation Districts.
[88] Agricultural Engineers design and implement technologies that improve water efficiency, soil health, and sustainable farming infrastructure. Also called Agricultural Systems Specialist, Conservation Engineer, Field Engineer, Product Engineer, Product Technology Scientist, Research Engineer. Can include engineers employed at Resource Conservation Districts.
[89] O*NET OnLine, U.S. Department of Labor (https://www.onetonline.org/)
[90] Occupation defined in accordance with the nomenclature of the Standard Occupational Classification system used in federal labor statistics. While this occupational category includes both urban and wildland firefighters, emphasis is placed on wildland firefighters due to their central role in NWL BARCAP measures.
[91] CRMs are rangeland professionals recognized in California for applying scientific principles to manage rangelands. The California CRM designation is a state license under the California Board of Forestry and Fire Protection.
[92] Administered by the California Department of Public Health (CDPH).
[93] ISA offers several voluntary certifications that demonstrate a professional arborist has attained a high standard of knowledge and skill in tree care.
[94] Certification offered through the American Institute of Certified Planners (AICP).
[95] Certification offered through the American Planning Association (APA).
[96] CRMs are rangeland professionals recognized in California for applying scientific principles to manage rangelands. The California CRM designation is a state license under the California Board of Forestry and Fire Protection.
[97] Provided by the CA Board of Forestry and Fire Protection.
[98] Provided by the CA Board for Professional Engineers, Land Surveyors, and Geologists (BPELSG).
[99] A CRD is new type of financing district enabled by California's SB 852, which allows cities, counties, and special districts to coordinate across jurisdictional boundaries to implement climate adaptation and resilience strategies. The role of a CRD is to secure public, private, state, and federal funds to support locally-determined climate and clean energy priorities. https://rcpa.ca.gov/what-can-a-climate-resilience-district-do-for-your-community/
[100] This list is not exhaustive, and other key partners and funders in the space may be absent.
[101] Data from JobsEQ. 2025Q1. Figures reflect total employment for each occupation across all industries and sectors, not limited to those directly associated with the BARCAP sector.
[102] Percent change in employment across the state of California. Data from Long-Term Occupational Employment Projections, California Open Data Portal (https://data.ca.gov/dataset/long-term-occupational-employment-projections/resource/274e273c-d18c-4d84-b8df-49b4d13c14ce)
[103] Location quotients (LQ) measure the concentration of an occupation in a local/regional area by comparing its share of employment to its share of national employment. An LQ greater than 1 means the occupation is more concentrated locally than nationally, while an LQ less than 1 indicates less concentration. Data from JobsEQ. 2025Q1.
[104] Data from JobsEQ. 2025Q1.
[105] "Bay Area Priority Climate Action Plan Appendix E: Workforce Planning Analysis Documentation." BW Research and Bay Area Air District, 2024. https://www.baaqmd.gov/en/plans-and-climate/climate-planning/bay-area-regional-climate-action-planning-initiative/priority-climate-action-plan

Appendix A: Methodology

Current and future workforce estimates were derived from existing literature and datasets that highlight activities similar to those outlined in the BARCAP and supplemented with proportional adjustments to reflect region-specific counties. For research that was initially developed at the state level, BARCAP region-specific estimates were scaled using the ratio of BARCAP region employment to state employment within the industries that are most relevant to the respective sectors.

This methodology makes a few assumptions, the greatest being that future growth trends will follow existing growth patterns. This assumption may not hold in instances where entirely new industries are formed, activities occur within industries outside of those originally captured, or where the BARCAP region takes on activities within a sector at an accelerated rate relative to the rest of the state.

In addition, the studies used represent the best available research, yet they do not perfectly align with the full range of activities in the BARCAP measures. Some studies may be more aggressive than the BARCAP measures and lack sufficient detail to better tailor data from the study to the measures. However, the studies are inclusive of the respective measures, align with the scope of the activities conducted and the types of occupations created, and address both the challenges and opportunities involved in building a workforce capable of meeting BARCAP goals. In these instances, the projected future demand may overestimate the number of additional workers needed. Future analyses geared towards providing policymakers and training providers with detailed anticipated workforce estimates may consider utilizing tailored economic impact models built on programmatic cost data or labor-intensity tools to more accurately forecast the quantitative needs for specific occupations.

Transportation Sector

Current and future employment estimates were sourced from the UC Institute of Transportation Study.[1] Additional estimates for Measures T-3 and T-4, which relate to transportation reduction or mode switching as opposed to fuel switching (in Measures T-1 and T-2) were included. These estimates followed the methods utilized in the Bay Area's Priority Climate Action Plan,[2] and proportion the spending utilized in the "Evaluating Benefits from Transportation Investments Aligned with the Climate Action Plan for Transportation Infrastructure (CAPTI)"[3] report to proportion the estimated spending on Measure T-3 and T-4 related activities.

Building Sector

Current employment was calculated by summing county-level Energy Efficiency data from the U.S. Energy and Employment Report across the eight counties in the BARCAP region. Future demand projections were based on the 2019 *California Building Decarbonization Workforce Needs and Recommendations*[4] by UCLA and Inclusive Economics. The research team took these employment estimates and proportioned them to the relative share of devices (heat pumps and NOx-emitting equipment replacement) anticipated to be installed through BARCAP measure B-1.

Power Sector

Current employment was estimated by aggregating county-level Electric Power Generation data from the U.S. Energy and Employment Report. Forecasted demand was based on state-level projections from Vibrant Clean Energy,[5] apportioned to the BARCAP region using the proportion of employment in the region within relevant industries—in this case, Utilities (NAICS 22) relative to the broader state. By utilizing employment within utilities to proportion these employment numbers, much of the employment impacts of constructing large-scale electricity generation projects, which are disproportionately less likely to be built within BARCAP region, are mitigated. Employment within the Utilities sector will continue to be very important as electricity providers increasingly have to monitor, operate, and plan for a greater number of the Distributed Energy Resources (DERs) coming online (as is detailed in BARCAP measures P-1 and P-2).

Waste and Materials Sector

Future employment estimates were taken from existing data from UC Berkeley Labor Center.[6] The report utilized 2016 Bureau of Labor Statistics Occupational Employment and Wage Statistics (BLS OES) data to estimate current employment in this sector. Current employment numbers were taken from the latest BLS OES data (May 2024) for the same NAICS codes used in the report to provide the most up-to-date figures.

Natural and Working Lands Sector

Employment estimates for this sector were derived using the Quarterly Census of Employment and Wages (QCEW) from the California Open Data Portal, aligned with relevant NWL North American Industry Classification System (NAICS) codes. These codes were selected based on the BARCAP definition of the NWL sector and informed by desktop research of California reports that assess land management industries and activities. The following NAICS codes were included: 111, 112, 112, 11511, 11521, 11531, 22131, 23799, 333111, 54162, 56173, 813312, 92512, 92613. Future employment estimates were drawn from economic modeling conducted in the CARB 2022 Scoping Plan.[7]

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[1] "Driving California's Transportation Emissions to Zero." University of California Institute of Transportation Studies, 2021. https://escholarship.org/uc/item/3np3p2t0

[2] "Bay Area Priority Climate Action Plan Appendix E: Workforce Planning Analysis Documentation." BW Research and Bay Area Air District, 2024. https://www.baaqmd.gov/en/plans-and-climate/climate-planning/bay-area-regional-climate-action-planning-initiative/priority-climate-action-plan

[3] "Evaluating Benefits from Transportation Investments Aligned with the Climate Action Plan for Transportation Infrastructure (CAPTI)." San Jose State University Mineta Transportation Institute, 2023. https://transweb.sjsu.edu/sites/default/files/2227-Alexander-California-Climate-Action-Plan-Transportation-Infrastructure.pdf

[4] "California Building Decarbonization Workforce Needs and Recommendations." UCLA Luskin Center for Innovation, 2019. https://innovation.luskin.ucla.edu/wp-content/uploads/2019/11/California_Building_Decarbonization.pdf

[5] "Role of Distributed Generation in Decarbonizing California by 2045." Vibrant Clean Energy, 2021. https://vibrantcleanenergy.com/wp-content/uploads/2021/07/VCE-CCSA_CA_Report.pdf#:~:text=The%20total%20full%20time%20equivalent,scale%20solar%20and%20storage%20by

[6] "Putting California on the High Road: A Jobs and Climate Action Plan for 2030." UC Berkeley Labor Center, 2020. https://laborcenter.berkeley.edu/wp-content/uploads/2020/08/Chapter-9-Waste-Sector-Putting-California-on-the-High-Road.pdf

[7] "Scoping Plan for Achieving Carbon Neutrality." California Air Resources Board (CARB), 2022. https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents

Appendix B: Ecosystem of Initiatives Across BARCAP Sectors

The following list of initiatives and efforts highlights several key organizations that apply to all five sectors. It should not be considered an exhaustive list. See the appendix to this document, Appendix D: References, for links to programs.

Organization / Initiative / Program	Description
Anchoring Worker Cooperative Hubs	Plan to develop worker-owned co-op centers in each Bay Area county to empower excluded workers and expand access to green economy opportunities
High Road to Early Childhood Education Consortium	Expands affordable childcare, addressing the need for subsidized care during non-traditional hours
Regenerative Jobs Program	Offers environmental-based workforce training and holistic career development for underrepresented communities
Clipper START	Provides discounted public transit rides to eligible individuals in Equity Priority Communities to expand job access
Kids Konnect Childcare Financial Assistance Programs	Partners with multiple organizations across California to offer subsidized childcare and provide support to families looking for quality childcare
Bay County ARPA Childcare Grant Program	Awards $300,000 to expand childcare capacity and access in Bay County, addressing workforce shortages and affordability barriers
Oakland Forward	Provides paid employment and career development for youth ages 16–30 in climate resilience, public service, and public safety sectors
Women's Environmental Network (WEN)	Builds a Bay Area community of women advancing environmental leadership, careers, and stewardship
Young Professionals in Energy	Connects energy professionals through networking, tours, and educational events to foster industry leadership and community engagement
East Bay Works	Offers free employment services and support to job seekers and youth through a regional network of job centers and partners
Youth Opportunity Pathways (YOP)	Equips Bay Area youth with career skills and hands-on learning through nonprofit and corporate partnerships, with youth co-designing their pathways
SEI's Climate Corps	A fellowship program that trains and places emerging professionals in sustainability and climate action roles through hands-on project experience

Appendix C: Ecosystem of Funding

The following table outlines several key workforce funding opportunities by sector that are available at the time the BARCAP is published. It does not represent an exhaustive list of available funding. See the appendix to this document, Appendix D: References, for links to funding programs.

A variety of federal and state grant portals, agency solicitation sites, and workforce and climate funding resources informed this funding inventory review, including:

- Grants.gov
- California Grants Portal
- California Energy Commission Solicitations
- Federal Green Economy Public Funding Tracker - UC Berkeley Labor Center
- Department of Labor Grants | U.S. Department of Labor
- Funding Opportunities | Department of Energy
- Funding Resources - California Climate and Energy Collaborative
- Grant Information | California Workforce Development Board
- California Climate Investments Funding Resources
- California Employment Development Department
- California Air Resources Board
- CalRecycle Funding
- California Department of Conservation Funding, Grants, & Easements

BARCAP Sector	Funding Program	Grantor	Description	Funding Amount
All Sectors	Employment and Training Pathways Program (ETPP)	California Employment Development Department	Supports projects that expand access to high-quality, career-connected learning for Californians facing systemic employment barriers, including English language learners, justice-involved individuals, opportunity youth, and veterans	$500,000 – $2,000,000
All Sectors	Sales Tax Exclusion (STE) Program	California State Treasurer's Office	Provides sales and use tax exclusions for manufacturers investing in clean energy, recycling, and advanced manufacturing equipment, supporting innovation and job creation	Total available: $100,000,000
All Sectors	Employment Training Panel (ETP) Funding	California Employment Training Panel	Provides funding to employers to deliver workforce training that upgrades employee skills, supports job retention, and promotes	Case Dependent/TBD

			high-wage, long-term employment opportunities	
All Sectors	Apprenticeship Innovation Funding (AIF)	California Department of Apprenticeship Standards	Invests in expanding and sustaining apprenticeship programs across non-traditional industries to scale workforce development in high-demand sectors	Approx. $22,000,000 for FY25-26
All Sectors	Homeless Veterans Reintegration Workforce Program	U.S. Department of Labor - Veterans Employment and Training Service	Supports veterans reach their full employment potential and obtain high-quality career outcomes; helps veterans return to work by providing job training services that support their needs	Program Funding: $23,000,000 Award Minimum: $150,000 Award Maximum: $500,000
All Sectors	Helping Justice-Involved Reenter Employment (HIRE)	California Workforce Development Board	Aims to increase employment opportunities and job mobility for justice-involved individuals by supporting training, supportive services, reskilling and upskilling, and needs-related payments	Available Funding: $50,000,000 Amount Awarded: $29,289,309
All Sectors	Workforce Accelerator 12 Grant Program	California Workforce Development Board	Supports local workforce board development and implementation of projects that incorporate High Road strategies	Available Funding: $3,000,000 Amount Awarded: $2,900,000
All Sectors	Workforce Accelerator 13 Grant Program	California Workforce Development Board	Focuses on workforce development projects that will drive quality jobs for California workers, incorporating High Road principles into projects that improve job quality, create upward mobility, and bridge workforce programs to quality jobs for workers from disadvantaged or low-income communities	Available Funding: $3,000,000 Amount Awarded: $2,900,000
All Sectors	Employment Pathways Technical Assistance Grant	California Employment Development Department	Provides funding for technical assistance and developmental evaluation to grantees of the PY 25-26 Employment and Training Pathways Program grants	Total available: $1,500,000
Buildings	MCE Support to Grow Contractor Business	MCE	Supports residential contractors in Bay Area counties by offering funding, training stipends, and access to pre-vetted job seekers to help grow their businesses	$3,500+
Buildings	YouthBuild 2025	U.S. Department of Labor - Employment and Training Administration	Provides pre-apprenticeship construction skills training, education, and job placement services to opportunity youth and prepares participants for quality jobs in various industry sectors; includes wrap-around supportive services such as assistance in transportation, childcare, and housing.	Program Funding: $98,000,000 Award Minimum: $1,000,000 Award Maximum: $2,000,000
Natural & Working Lands	Career Pathways Grants Program	Parks California	Funds partnerships that provide career training and mentorship to support workforce development in California parks, integrating	Case Dependent/TBD

			diverse perspectives and Indigenous knowledge into public land stewardship	
Transportation	Caltrans Sustainable Transportation Planning Grant	California Department of Transportation	Funds multimodal transportation and land use planning initiatives that reduce greenhouse gas emissions, improve system performance, and support economic equity by enabling opportunities for individuals with barriers to employment	$50,000 – $700,000
Transportation	Human Resources & Training - 5314 (b)	U.S. Department of Transportation Federal Transit Administration	Supports public transportation workforce development through innovative training, research, outreach to underrepresented populations, and national standard-setting in partnership with industry stakeholders	Case Dependent/TBD
Transportation	CEC Clean Transportation Program	California Energy Commission	Funds workforce training and development initiatives to grow California's zero-emission vehicle and infrastructure workforce, creating long-term career pathways in the clean transportation sector	Case Dependent/TBD
Transportation	Planning Capacity Building Grants	California Air Resources Board	Supports early-stage planning, outreach, workforce development, and community readiness for equitable clean transportation solutions, with a focus on Tribal, rural, school-based, and first-time applicants	Up to $500,000 per award
Transportation	Pay-for-Performance Incentive Payments Program	U.S. Department of Labor - Employment and Training Administration	Incentivizes the expansion and growth of the National Apprenticeship System, specifically in the following sectors: transportation, AI/semiconductors/nuclear energy, IT, healthcare, telecommunication, shipbuilding/defense	Program Funding: $145,000,000 Award Minimum: $10,000,000 Award Maximum: $40,000,000
Waste & Materials	Edible Food Recovery Grant Program	CalRecycle	Funds projects that expand food recovery and waste-reduction efforts to keep food out of CA landfills	TBD

Appendix D: References

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