Advancing Equity in California Climate Policy:

A New Social Contract for Low-Carbon Transition

Center for Labor Research and Education
Donald Vial Center on Employment in the Green Economy
University of California, Berkeley

A report by

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Contents

CONTINUED

Photos

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page 62: IBEW Local 569
page 65: LAANE
page 67: LAANE
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Reversing climate change and addressing income inequality are the twin challenges of our time. Solving them both means a safer, more stable future for generations to come. If we don't stop and reverse climate change, our environment and our economy could collapse. If we don't address the growing gap between rich and poor, our political structures and our economy will continue to fray, robbing us of both the funds and the political will to address climate change.[1]

Tom Dalzell
Business Manager and Financial Secretary
International Brotherhood of Electrical Workers Local 1245

Why do we care about jobs? Because we know that a good-paying and safe job is important to a good life and good health of families and our communities. And we know that the same people and powers that destroy our environmental health are also exploiting working people. We see that we are bound together and that, even though we may disagree now and then, our interests are the same.[2]

Diane Takvorian
Executive Director
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EXECUTIVE SUMMARY

California's leadership role in climate policy has once again been confirmed by the passage of Senate Bill 32 (Pavley, 2016), which commits the state to the ambitious target of reducing greenhouse gas emissions to 40 percent below 1990 levels by 2030—staying the course to an 80-percent reduction by 2050. A central issue in the SB 32 political debate, as well as the many related policies that preceded it, is the impact of climate policy on equity: how to ensure that low-income and working-class Californians do not disproportionately bear the costs and are included in the benefits of California's transition to a low-carbon economy. This report presents a Climate Policy Equity Framework to assist California decision-makers interested in reducing greenhouse gas emissions in ways that promote economic, social, and environmental equity. We suggest that policymakers, regulators, community groups, advocacy organizations, and business interests should develop a "social contract" to manage a transition to a low-carbon economy that both maximizes the benefits of low-carbon economic development and minimizes the risks to working people and disadvantaged communities. This social contract can strengthen the broad political coalition needed to stay the course on the state's ambitious greenhouse gas reduction goals, particularly in the face of accelerating greenhouse gas emission reductions and a legal challenge to the constitutionality of California's cap-and-trade system.[3] The Climate Policy Equity Framework can then guide policy development and program implementation to reflect and support the social contract.

But what is climate equity? How can it be defined in a way that promotes both good jobs *and* prioritizes those communities that are hardest hit by climate change, multiple environmental hazards, and socioeconomic stressors? What key criteria can then be used to develop and assess policies such as renewable portfolio standards, incentives for energy retrofits, cap and trade, transit-oriented development, low-carbon fuels and vehicle deployment, and much more? And finally, when faced with trade-offs between different equity criteria or tensions between environmental justice and labor interests, how can decision-makers maximize equity outcomes?

To answer these questions, this report proposes a "Climate Policy Equity Framework" that operates at three levels to:

- Articulate equity principles and goals to guide policy design;
- Present key criteria to analyze how close a particular climate policy or program comes to meeting these equity goals; and
- Propose indicators that point the way to mechanisms and strategies to advance climate equity.

We then apply these equity criteria to assess progress on environmental justice, economic equity, and public accountability goals, using the limited data currently available. Our assessment highlights positive developments, remaining challenges, and the data gaps that must be filled to facilitate more complete assessments in the future. We also apply the criteria and indicators to two specific climate policy arenas—energy efficiency and renewable energy—to illustrate how to improve the equity outcomes of specific climate policies and programs. Finally, we present a preliminary set of recommendations to illustrate some concrete opportunities for equitable climate initiatives.

BACKGROUND

California's voters and elected officials have embraced the imperative of addressing climate change by pursuing aggressive strategies to curtail greenhouse gas (GHG) emissions. From the carbon reduction targets set in the state's landmark 2006 Global Warming Solutions Act (Assembly Bill 32) to the mandate to procure 50 percent of the state's electricity from renewable energy and to double energy efficiency savings by 2030 in Senate Bill 350 (2015) to the commitment to reduce greenhouse gas emissions to 40 percent below 1990 levels by 2030 in Senate Bill 32 (2016), the Golden State is leading by example with the most comprehensive set of multisector climate policies in the nation.

In addition to the climate crisis, California faces a crisis of growing disparities in income, wealth, and public health. The increase of low-wage work has been a direct contributor to economic inequities. At the same time, an expanding body of research demonstrates that economic and racial inequality influences where people live, work, and play, and what health risks they are exposed to as a result of their location. Indeed, study after study has demonstrated that inequity goes beyond the economy: air quality is worse, and health risks are higher for communities of color in the state, contributing to a "climate gap" in which the greatest effects of climate change may be felt by populations already challenged by economic and social disadvantage.

Improving climate equity will require reducing disparities across generations, groups, and geographies. While many economists—and more than a few politicians—believe that disparities are simply a necessary (although unfortunate) consequence of economic growth, recent research shows otherwise: high levels of inequality are toxic for economic prosperity and sustainability. Research on environmental and health disparities parallel this finding, revealing that environmental injustices have negative spillover effects for society at large.

In California, the road to climate policy runs through—not over—climate equity.

Moreover, many advocates have recognized both the need and the opportunity to broaden the political coalition for climate action beyond traditional environmental groups. Polling from the Public Policy Institute of California consistently shows that low-income residents and people of color express significantly greater concern about climate change than upper-income and white respondents. As California's non-white populations grow, so does their representation in the state legislature, as evidenced by the rising importance of Latino caucus members proposing policies to address both climate issues and the interests of disadvantaged communities and low-wage workers. Support for climate policy from the labor movement is increasingly essential, as labor unions step up their engagement in climate legislation. In California, the road to climate policy runs through—not over—climate equity.

Equity Concerns and Policy Advocacy in the Labor and Environmental Justice Movements

Advocates from environmental justice (EJ) groups and labor unions have been actively involved in California's climate policy debates, bringing different perspectives to bear on climate policy and its implementation. These groups have pushed to make "climate equity" a guiding principle in climate policy, albeit with somewhat different interpretations of what the goals of climate equity should be.

EJ advocates have been deeply concerned about cap and trade exacerbating toxic hotspots in communities near polluting facilities. Cap-and-trade programs allow businesses to choose to trade allowances or buy offsets instead of reducing GHG emissions—and only the latter will lead to the reduction of co-pollutants (the toxic air pollution that accompanies GHG emissions). Given the state's commitment to cap and trade, EJ groups have fought a rearguard battle to insure that some of the funds generated from the cap-and-trade program go precisely to those communities. And as evidence has mounted that public and ratepayer investments have concentrated in more-affluent populations, EJ organizations have worked to ensure that disadvantaged communities have access to renewable energy, zero emission vehicles, and other low-carbon goods and services.

Meanwhile, labor unions and their allies have advocated for a low-carbon economy that generates good jobs and protects middle-class workers as their industries change. Significant progress has been made on this front, most recently with the passage of the Renewable Portfolio Standard (RPS) in Senate Bill 350, which will expand opportunities for unionized construction workers. Jobs in utility-scale renewables, which are counted towards meeting the RPS, are good jobs—with family-supporting wages, skills development through apprenticeship training, and strong benefits. But not all the "green" jobs generated by climate policy are good jobs, and the building trades and other unions fear that the trend toward low-wage work will spread within the low-carbon economy. There are also concerns for the potential loss of middle-class jobs in fossil fuel industries that may be at risk of decline.

A Climate Equity Framework

What does a new social contract for the low-carbon transition look like? One that addresses climate effectively, reduces rather than exacerbates inequality, and builds a sustainable political coalition? We offer here a "Climate Policy Equity Framework" that poses three questions intended to steer policy design and evaluation in a more sustainable and equitable direction. They are:

- **Does the policy promote Environmental Justice?**
  Climate policy should aid the state's most environmentally impacted and socioeconomically disadvantaged communities by reducing environmental health risks; expanding access to beneficial goods and services; and increasing both community-level resilience and access to resources from public investments in low-carbon goods and services.

- **Does the policy promote Economic Equity?**
  Climate policy should generate high-quality, career-track, and family-sustaining jobs in clean economic growth sectors; include specific efforts to create pipelines to these jobs for workers from disadvantaged communities; and contain supports for workers and communities in carbon-intensive industries at risk of disruption or decline due to climate policy.

- **Does the policy promote Public Accountability?**
  Climate policy should embrace inclusive, effective participation in decision-making; identify and incorporate constituencies at every stage in the process; and utilize a robust set of indicators that benchmark and measure progress on sustainability and equity goals—and quickly change policy if it does meet the grade.

This report further defines specific criteria under each of these three principles and presents the available evidence on progress and remaining challenges, while noting the significant data gaps that prevent a full evaluation.

Table 1 presents the goals and criteria for the principle of environmental justice.

Table 1

Principle 1. ENVIRONMENTAL JUSTICE

No.	Criteria
Goal:	Reduced environmental and public health risks to disadvantaged communities.
EJ1	Decreases pollution regionally *and* locally in toxic hotspots.
EJ2	Improves public health outcomes associated with pollution exposure and climate vulnerability.
Goal:	Expanded access to benefits in disadvantaged communities.
EJ3	Expands access to goods and services arising from clean, low-carbon development (e.g., renewable energy, low-carbon mobility).
Goal:	Protection from adverse economic consequences for disadvantaged communities.
EJ4	Avoids raising the cost of electricity, transportation fuel, and water for disadvantaged communities.
EJ5	Increases economic and social resilience to gentrification-induced displacement created by low-carbon urban development.

A key concern of environmental justice advocates has been whether cap and trade is causing adverse or suboptimal impacts in disadvantaged communities, partly because the combination of offsets and carbon-only pricing can fail to reduce local health-harming co-pollutants. At this point, there is not enough information to determine whether such adverse impacts are occurring; this is an area where data limitations undermine our ability to assess the problem. Although the California Air Resources Board (CARB)—the state's cap-and-trade regulator—is working to evaluate the environmental justice impacts of carbon trading, it is not clear to what extent CARB will include co-pollutants in its assessment or how it will respond if adverse impacts are discovered. On the positive side, cap and trade has generated investment for some of these disadvantaged communities (almost $2.4 billion for fiscal years 2012/13 through 2015/16) for a variety of programs that promise to improve air quality and public health outcomes. Here, too, it is difficult to assess whether and how these outcomes have improved due to data limitations.

A number of other climate policies and programs have begun to focus on expanding access to the benefits of low-carbon economic growth in disadvantaged communities, including cost savings on utility bills and job training and employment opportunities. With some exceptions, public and utility incentives that encourage the adoption of low-carbon goods and services have concentrated in wealthier households that have the resources needed to reap the economic benefits of rooftop solar installations or electric vehicles. To make these and other goods more accessible to low-income households, a number of climate policy programs have put in place a patchwork of new incentive programs (e.g., the

Multifamily Affordable Housing Solar Roofs Program and the Charge Ahead California Initiative) and older, well-established programs (e.g., utility low-income weatherization programs) that carve-out special subsidies for low-income households. Increasingly, policymakers and regulators are attending to the disparities that emerge when access to low-carbon goods and services depends on owning significant assets.

There are also growing equity concerns about the potentially regressive effects of climate policy in which low-income consumers carry a disproportionate burden of the costs of climate policy. In some cases, new or existing regulations help mitigate the rising costs of basic necessities like electricity and water. For others goods, like transportation fuel, regulatory safeguards do not yet exist to prevent companies from passing increased costs of climate policy on to consumers. Without mechanisms in place to counteract regressive effects, low-income households in disadvantaged communities are likely to suffer. This concern is especially real for those who may be impacted by processes of gentrification due to transit-oriented development. These and other risks make community-level resilience an important priority for climate policy.

Table 2 presents the goals and criteria for the principle of economic equity.

Table 2

Principle 2. ECONOMIC EQUITY

No.	Criteria
Goal:	High-quality, career-track jobs in clean economic growth sectors.
EE1	Generates jobs with family-supporting wages, benefits, career paths, and safe and healthy working conditions.
EE2	Supports prevailing wage and skilled workforce standards in the construction industry.
EE3	Increases access to career-track jobs for workers from disadvantaged communities.
Goal:	Just transitions for workers and communities in sectors at risk of decline due to climate policy.
EE4	Provides income supports, retraining, and job placement into comparable jobs for displaced workers or bridges to retirement for older workers.
EE5	Supports economic development for communities affected by plant closures and sector shrinking.

The key concerns that labor and jobs advocates focus on are job quality (wages, benefits, working conditions, and career paths of the jobs being generated in the new economy), job access (who is getting the jobs), and potential loss of family-supporting, middle-class, unionized jobs in the old energy economy. A review of the available evidence indicates that California climate policies have resulted in modest positive net job creation (growth minus decline) and significant job growth in specific segments of the

IBEW Local 569

clean energy economy, particularly in renewable energy generation and energy efficiency. However, while the data is too limited for a comprehensive assessment, there is evidence that this job growth has not always led to high-quality, career-track employment opportunities. While job loss is not an immediate risk, the state does not yet have a comprehensive plan on how to mitigate this risk as emissions targets become more stringent.

The main success story for job quality is utility-scale renewables, whose growth has been induced by California's Renewable Portfolio Standard (RPS), which currently sets a target of 50-percent renewable energy by 2030. This initiative is a key legislative victory for the state's building trades unions, as the RPS has generated significant numbers of union-wage jobs with full health and welfare benefits and investment in training through apprenticeship. However, available evidence shows that distributed solar (commonly known as rooftop solar) generation is much lower wage and lacks a career ladder, even while it offers the most potential to site renewables in disadvantaged communities. Jobs in energy efficiency are of mixed quality. Indicators suggest that these jobs follow the general pattern of the construction labor market: career-track jobs with benefits and training predominate in publicly funded construction and unionized commercial and industrial market segments, while jobs with much lower wages and fewer benefits are found in non-union and residential segments.

Meanwhile, evidence is almost nonexistent on job access—e.g., the extent to which workers from disadvantaged communities are being hired into career-track job opportunities in the low-carbon economy. We identify specific interventions to improve job access—community workforce agreements (CWAs)—that have been successful in the broader construction industry in California but are not yet common in clean energy construction projects. This reality may be changing, however, as these interventions and approaches are being implemented in high-speed rail, some utility-scale renewables, and the Los Angeles Department of Water and Power (LADWP) low-income energy efficiency program, which we highlight in our case study on energy efficiency.

Finally, there is no evidence to date that climate policy has caused job loss, thanks to California's long history of environmental regulations, lack of dependence on coal, and the specific cap-and-trade policy of allocating free allowances to industries at risk of emissions (and jobs) leakage. While job loss is not yet a concern, planning for even modest risk of industry decline in fossil fuel industries is important to ensure a "just transition," so that workers and communities are protected.

Table 3 presents the goals and criteria for the principle of public accountability.

Table 3

Principle 3. PUBLIC ACCOUNTABILITY

No.	Criteria
Goal:	Enhanced participation in public decision-making.
PA1	Fosters inclusive and effective participation of key constituencies at every stage of the decision-making process.
Goal:	Transparent monitoring of equity outcomes.
PA2	Translates desired equity outcomes into measurable benchmarks for continuous monitoring.
PA3	Generates reliable, consistent, publicly available data on equity outcomes.
Goal:	Continuous learning and improvement.
PA4	Allows for midcourse corrections and policy learning to advance equity goals.

The public accountability criteria address both environmental justice and economic equity by ensuring the participation of key constituencies in public decision-making and tracking progress towards desired equity outcomes. California has a strong track record of public participation in climate decision-making and has made significant progress on monitoring, but there are opportunities to strengthen the voices of equity advocates and further develop the data collection and reporting infrastructure needed for monitoring.

The environmental justice community now has direct representation via two designated appointments on the California Air Resources Board (CARB), which oversees AB 32 implementation. Likewise, the Strategic Growth Council, which oversees initiatives authorized by SB 375 to encourage low-carbon transportation and urban development, also benefits from EJ perspectives, though not through formal designation. Labor has not been accorded the same legitimacy in the form of designated appointments on regulatory boards.

Likewise, the state has made substantial progress in building the data infrastructure needed to address equity concerns. The CalEnviroScreen tool ranks communities according to their exposure to pollution from multiple sources and the vulnerability of the resident population to its effects, literally putting disadvantaged communities on the map. This resource has raised the public visibility of the interests and needs of disadvantaged communities for the purposes of targeted investment from cap-and-trade revenue. However, gaps in data collection and reporting still prevent us from clearly seeing where progress is being made and where problems remain unaddressed. To improve our ability to benchmark and monitor desired equity outcomes, we need better data on cap-and-trade sources and transactions,

changes in local co-pollutant emissions, job growth and loss, and job quality and access for members of disadvantaged communities. Improving the availability of good data on equity outcomes will afford a clearer picture, which in turn can help inform more policy to ensure that public subsidies and ratepayer investments are fairly distributing the costs and benefits of climate policy among California's households and communities.

Incorporating Equity Principles in Two Arenas of Climate Policy: Energy Efficiency and Renewable Energy

To demonstrate the utility of the Climate Policy Equity Framework, we assess two GHG reduction strategies in the electricity sector: energy efficiency and renewable energy. In both examples, we use this framework to show how reducing GHG emissions while promoting equity is possible.

The first example is the low-income weatherization program implemented by LADWP. This example illustrates how energy efficiency programs can provide benefits to low-income households, generate family-supporting and career-track unionized jobs, and provide a pathway into these good jobs for workers from disadvantaged communities. It also underscores the important role of coalition building among EJ, labor, economic equity, and environmental organizations, which have provided the political momentum to advance a stronger climate and social equity agenda simultaneously. Incorporating labor standards and other features of the LADWP program is possible and should occur, not only in the low-income programs administered by the investor-owned utilities (IOUs) and those programs funded by the Greenhouse Gas Reduction Fund, but also in the IOUs' other (non-low-income) energy efficiency incentive programs, which represent the state's largest energy efficiency funding stream. We also propose an expanded commitment to energy efficiency retrofits in the MUSH (municipal, university, school, and hospital buildings) and multifamily affordable housing markets, which can produce deeper retrofits due to long-term public or non-profit ownership and concomitant long payback periods, and which use Community Workforce Agreements (CWAs) with prevailing wage and apprentice standards and local hire provisions to help improve job quality and job access. An added benefit for

To improve our ability to benchmark and monitor desired equity outcomes, we need better data on cap-and-trade sources and transactions, changes in local co-pollutant emissions, job growth and loss, and job quality and access for members of disadvantaged communities.

realizing energy savings is the harnessing of the state's certified apprenticeship system, which produces the best-trained construction workforce in the state. These strategies can expand the positive impact of state and ratepayer funded energy efficiency programs on equity, while ramping up to achieve SB 350's goal of doubling energy savings by 2030.

The second example looks at renewable energy, specifically solar energy deployment. The equity framework highlights the challenges that arise when labor and EJ have prioritized different segments of the solar industry and the new models of solar deployment that can overcome these challenges. Building trades and utility workers unions support utility-scale solar, which has generated good union jobs. They were major and critical supporters of SB 350's new 50-percent RPS for that reason. The unions also lobbied state lawmakers to limit other regulations (like net energy metering) that favor distributed rooftop solar, which is generally low wage and non-union. EJ groups share labor's concern about sustainable wage jobs with pathways to middle-class careers but also seek to expand local renewable energy in disadvantaged communities. As a consequence, EJ groups have supported distributed rooftop solar, promoting policies that expand subsidies to households in disadvantaged communities. These positions have put EJ groups and labor on opposing sides in a number of policy fights about solar.

Policymakers and advocates should consider the Climate Policy Equity Framework as they implement current climate initiatives and develop future policies.

Labor and environmental justice groups have held several meeting in recent years with the goal of finding alignment on values and principles, working towards a joint policy platform that addresses the concerns of both constituencies. We use the Climate Policy Equity Framework to illustrate ways to find common ground as multiple solar business models evolve. In utility-scale solar, there can be a stronger commitment to having explicit targeted-hire goals and jobs-tracking systems. In distributed solar generation, community solar offers a model that can serve multiple households and businesses in a locality, expanding access beyond those who own solar-friendly roofs, bringing benefits and jobs to a local level in a more cost-effective manner than small-scale rooftop solar, and providing more fertile ground for the adoption of labor standards and CWAs. And, as boundaries between rooftop and grid-scale solar deployment models increasingly blur due to changing business models in the electricity sector, labor and EJ have the opportunity to influence regulatory responses and industry practices to meet climate *and* common equity goals.

Will this end all tensions? Surely not, but we suggest that while obvious "win-wins" open the first common ground between groups, there may be a wider range of policy agreements in specific contexts.

Working together can lead to better outcomes for labor, environmental justice communities, and the climate. There is also a need to recognize that disagreements do not need to produce dissension. On the other side of many of these disputes, there lurks a set of actors who do not value protecting the environment, enhancing job quality, or improving neighborhood quality of life. Keeping our eyes on the prize also means shifting our gaze to new and creative approaches that build political momentum for shared goals.

Looking Forward: Recommendations

In looking forward to building the low-carbon economy with a new social contract, we suggest that policymakers and advocates consider the Climate Policy Equity Framework as they implement current climate initiatives and develop future policies. While the following recommendations for GHG reduction strategies are by no means exhaustive—something well beyond the scope of this report—they do exemplify significant opportunities for improving equity in areas of climate policy of great concern to EJ and labor groups in California. Labor and EJ leaders developed many of these suggestions and others emerged through discussions with both labor and EJ organizations, including a number of meetings organized by EJ and labor groups and a workshop that the authors organized in March 2016 with advocates from a broad sample of unions and EJ organizations. While the participants did not officially endorse these recommendations on behalf of their organizations, the workshop allowed the authors to informally test their resonance.

1. Require labor standards on construction projects that the state funds, incentivizes, or mandates to meet GHG reduction targets.

Labor standards—including prevailing wage, benefit, and apprenticeship standards—are crucial mechanisms for ensuring that low-carbon economic development results in high-quality, family-supporting careers. Labor standards are often linked with targeted hire provisions to broaden access to career-track jobs for disadvantaged workers. A number of vehicles exist for attaching labor standards to state GHG reduction measures that involve construction work.

Energy Efficiency and Distributed Generation Incentive Programs:

Implement labor standards for renewable energy, energy efficiency, and other low-carbon construction projects subsidized by public investment and utility ratepayer incentive programs.

Greenhouse Gas Reduction Fund (GGRF), Proposition 39, and Other Public Investment Programs:

Require a community workforce agreement (CWA), or similar arrangements that include labor standards and targeted/local hire provisions, on fully subsidized public and ratepayer investments in low-carbon sectors.

Power Purchase Agreements (PPAs) for the Renewable Portfolio Standard (RPS):

Require a CWA on RPS-eligible, utility-scale renewables in power purchase contracts. Alternatively, give preference in the PPA selection process to projects with a multi-craft CWA.

Low-Income Weatherization Programs:

Require a wage floor and build career ladders for low-income energy efficiency retrofit programs funded by utilities and the GGRF.

2. Invest in GHG-reducing public works projects that reach low-income Californians.

Prioritizing low-carbon investments in the public sector (i.e., public buildings and public infrastructure projects) offers a variety of equity benefits by providing a vehicle for CWAs (see Recommendation 1) and ensuring direct investment in disadvantaged communities, while meeting GHG reduction goals.

MUSH Sector Energy Efficiency and Clean Energy Investments:

Create a comprehensive deep retrofit program for MUSH (municipal, university, school, and hospital) and multifamily affordable housing markets that incorporates a CWA and is funded by existing ratepayer, GGRF, and Prop. 39 funds.

Green Zones:

Support comprehensive GHG reduction and community resilience investments in the most disadvantaged communities, devised through a multi-stakeholder, community engagement process that includes both environmental justice and labor organizations.

3. Ensure equitable distribution of ratepayer and public incentive funds for private low-carbon investments.

Equity can be advanced by ensuring that programs to encourage adoption of solar, electric vehicle, and other low-carbon technologies do not require participants to be homeowners, have disposable savings, or have access to credit in order to benefit from government incentives. To the extent possible, decision-makers should design programs to incentivize low-carbon investments that are delinked from ownership of individual assets like homes or vehicles.

Community Solar Programs:

Expand community solar programs that provide distributed solar to multiple households (including pass-through benefits to renters), prioritize participation from disadvantaged households and siting in disadvantage areas, and require the incorporation of CWAs.

4. Ensure just transitions for workers and communities affected by the decline of GHG-emitting industries.

California is unlikely to lose jobs in the short term, but as we approach the stringent GHG reduction targets set for 2050, the risk of job loss may grow, particularly in sectors that are inextricably linked to fossil fuels, like oil and gas extraction and refining.

Industrial Planning for High GHG-Emitting Industries:

Identify a lead state agency and a funding source and initiate an inclusive planning process to mitigate transition losses for workers and communities potentially impacted by industrial decline due to climate policy.

5. Ensure that cap and trade does not exacerbate pollution hotspots in disadvantaged communities and amend the program where necessary.

Ongoing concerns about the possible adverse impact of the cap-and-trade system on existing environmental justice hotspots requires developing robust evaluation and collecting the data to monitor exposure, with a trigger to respond if cap and trade exacerbates pollution hotspots, particularly in disadvantaged communities. Addressing these issues requires:

Incorporation of co-pollutant emissions into CARB's GHG Emissions Mapping Tool.

Public reporting of cap-and-trade transactions by facility.

Restrictions on facility-level trading and offset purchases at facilities in prioritized disadvantaged communities when necessary.

6. Ensure participation from labor and EJ representatives in all climate policy arenas.

California can build on a strong track record of public participation by filling in the following gaps and incorporating the multiple equity criteria in its public processes.

Inclusion of Both Labor and EJ Voices in State Bodies Responsible for Implementing Climate Policy:

Fill gaps in labor and EJ representation on state bodies (such as CARB, CPUC, and CEC) tasked with decision-making and implementation related to AB 32 and other climate legislation.

Participatory Planning for the Sustainable Communities and Climate Protection Act (SB 375):

Implement a statewide participatory planning framework that clarifies a standard process for developing a Sustainable Community Strategy (SCS) to reduce the carbon footprint of urban development as mandated in SB 375.

7. Monitor equity performance across California's climate policies and programs.

California should collect consistent, reliable, and publicly available data to monitor performance on key equity indicators. Although measuring progress may seem like a small step, we highlight the importance of performance reporting, following the adage "what gets measured gets managed."

Statewide Public Accountability System to Track Equity Outcomes.

The state should develop an annual Climate Equity Report based on tracking equity outcomes to enable state officials to monitor whether equity goals have been reached, to identify areas where climate policy should be improved to advance equity, and to hold public bodies accountable for progress on equity in GHG reduction measures.

With the climate crisis brewing, the Golden State stands poised for an energy revolution and massive reworking of the state's built infrastructure. At stake, as well, is our social infrastructure: whether we will generate the high-quality employment and access to a clean environment that has long been a key part of the California Dream. To build on our significant progress, we need a bigger and broader movement concerned with both economic and environmental equity, one that can effectively counter backward-looking business interests that oppose climate policy but collaborate with business, civic, and agency leaders who support action. And to do this, we need the environmental justice and labor movements to model the sort of collaborative unity that creates broad and ongoing political support for a more sustainable and equitable California. Building a social contract for the transition to a low-carbon economy requires agreement among political actors about goals and strategies. We hope this report helps clarify the policy framework that is needed to implement and support such a social contract.

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Introduction

A solid majority of Americans now agree that government intervention is needed to limit the catastrophic impact of climate change.[4] While legislative action at the national level is still stalled, Californians and their elected leaders have moved forward, embracing the need for strong climate policy since the early 2000s. As the state is the world's eighth-largest economy and 14th-largest emitter of greenhouse gas (GHG) emissions, the California legislature has committed to the most aggressive state benchmark in North America: to lower GHG emissions to 80 percent below 1990 levels by 2050.[5]

The Golden State has emerged as a model for GHG reduction policies, both nationally and worldwide. California's strategy has been one of "mix and match," combining traditional command-control regulation, market-based incentives, and strategic public and utility ratepayer investment. In 2002, the state set the first rigorous Renewable Portfolio Standard (RPS) for the electricity sector, and in 2006, it passed the Global Warming Solutions Act (Assembly Bill 32) to set GHG reduction targets for 2020, which the state is on track to meet. In 2015, Senate Bill 350 passed, putting California on an even more ambitious path to generate half of its electricity from renewables and to double energy efficiency savings by 2030. This new law also requires utilities to accelerate the expansion of electric vehicle charging infrastructure to further reduce dependence on petroleum. And in 2016, California passed Senate Bill 32 (and its companion bill AB 197), which commits the state to the next phase of climate targets by requiring the state to reduce GHG emissions to 40 percent below 1990 levels by 2030. With these targets and a diverse set of climate policies, California is clearly on a path to transition to a low-carbon economy.

While California has led in climate change mitigation, it is also an unfortunate leader in inequality.

While California has led in climate change mitigation, it is also an unfortunate leader in inequality. Huge wealth, income, and wage disparities mark the state's social and economic landscape. Despite its booming high-tech economy, the Golden State now has the highest poverty rate in the nation.[6] Between 1980 and 2010, the incomes of California families in the poorest 10th percentile dropped roughly 24 percent; over the same timespan, the incomes of the wealthiest 10th percentile grew 34 percent.[7] Income inequality has risen even further after the Great Recession,[8] despite a steadily declining unemployment rate.[9] These trends in income and wealth disparities are even more pronounced by race.[10]

The growth of low-wage jobs for a large portion of California residents has been a key driver of inequality and declining well-being for the bottom third of the income distribution.[11] In 2014, 33 percent of California

workers held low-wage jobs (defined as jobs earning wages less than two-thirds of the median hourly wage for full-time workers). These approximately 4.8 million California workers held jobs paying less than $13.63 per hour, and their annual median earnings amounted to only $15,300.[12] Among low-wage workers, only a quarter have additional benefits such as health insurance or pensions from their employer. And while California's population has been majority people of color since 1999, ethnic and racial minorities are disproportionately low-wage workers: while black and Latino workers make up 44 percent of the workforce, they make up 62 percent of low-wage workers.[13]

The impact of inequality is not just economic. Like poor environmental conditions, low wages and other disparities "get under the skin."[14] A substantial body of research links low socioeconomic status to higher disease risks and shorter life expectancy. Often geography further exacerbates the social and health challenges resulting from low-wage work. For example, low-income communities and communities of color live, work, and play in physical locations that are more frequently beset by multiple environmental hazards and social stressors.[15] Members of these communities carry an increased risk of adverse health impacts due to the cumulative effects of being exposed to disproportionately high levels of air and water pollution, substandard housing, crime, and other stressors.

Given these alarming conditions and trends, many advocates and policymakers in California have sought to weave equity considerations into climate policy design. After all, climate change will likely make California's disparities worse, in part due to what is sometimes labeled the "climate gap": low-income communities and communities of color risk the greatest economic and health consequences from climatic shifts.[16] Equally worrisome is the fact that climate policies can actually harm blue-collar workers, low-income families, and communities of color when decision-makers craft GHG reduction strategies without considering the all-important distribution of costs and benefits. For example, when subsidies only help wealthy consumers purchase solar panels and electric vehicles, then public or ratepayer resources are diverted from those who remain vulnerable to the problems of job loss, low-wage work, existing pollution hotspots, higher energy prices, "heat islands," and other challenges.

Labor and environmental justice groups have significant common ground on equity matters in the climate policy arena.

The key political advocates of constituencies concerned with both climate change and inequality in California are community-based organizations that commonly work under the banner of environmental justice to alleviate poverty and pollution, and labor organizations that raise concerns about the need for family-supporting, career-track jobs. Both groups have engaged in climate policy, have the ear of key legislative leaders, and have had significant policy victories. Although they sometimes find themselves in conflicting positions, both groups also have overlapping concerns that have garnered support from

key elected officials. Partly as a result, state officials have enacted a number of crucial policies to address equity in climate mitigation, yet more progress is both needed and possible.

We believe that labor and environmental justice groups have significant common ground on equity matters in the climate policy arena. California's ambitious GHG goals offer significant opportunities to reduce the environmental and economic inequities of concern to both groups. And with the support and collaboration of both groups in climate policymaking, the state may progress more quickly towards its GHG reduction goals and be able to counter political opposition to policies promoting climate mitigation and climate equity, as was demonstrated by the recent passage of SB 32 and AB 197. Whether this progress continues depends on the ability of the advocates for these key constituencies to forge a shared equity agenda and provide the support elected officials need to steer the state's transition to a more equitable low-carbon economy.

We propose the Climate Policy Equity Framework to help advocacy groups, state lawmakers, and regulators advance a common-ground equity agenda for California climate policy. In this framework, we group shared equity criteria under three broad principles (see sidebar). Together, these criteria can be used to develop and evaluate climate policy proposals.

We do not pretend that agreement will be easy to forge: climate change is a complex challenge, and inequality is deeply embedded throughout our society. Bringing together diverse constituencies requires shared values, a common agenda, and trust that develops over time. We hope that this document supports a lasting conversation to build a new social contract to support the state's transition to a low-carbon economy and to support California's leadership role in addressing the climate crisis.

CLIMATE POLICY EQUITY PRINCIPLES

PRINCIPLE 1: ENVIRONMENTAL JUSTICE

for communities whose health and quality of life are most impacted by environmental hazards and socioeconomic stressors.

PRINCIPLE 2: ECONOMIC EQUITY

for workers to ensure that the clean energy economy generates family-supporting, career-track union jobs and to protect workers and communities that risk job loss in industries with high GHG emissions.

PRINCIPLE 3: PUBLIC ACCOUNTABILITY

through inclusive participation from affected constituencies and better access to information to assess progress towards climate and equity goals.

Finally, we should remember that doing nothing about climate change will lead to severe economic disruptions resulting from sea-level rise, drought, extreme weather events, and forest fires, which will

generate an economic, environmental, and moral rationale for being aggressive on climate policy. But there is also a distributional imperative: we can tackle the challenges of inequality weighing on the state and the nation through climate policy, and if we don't, the inequities in our overall economy are likely to be reproduced in the emerging clean energy sectors. The following review of California's climate change policies highlights both the impressive work that has been done to leverage equity issues in climate policy as well as the areas in which further improvement may be possible.

The report proceeds as follows:

Section 1 discusses why equity is important and outlines the concerns and advocacy of environmental justice and labor groups in California.

Section 2 presents the Climate Policy Equity Framework to guide policymakers in setting equity goals and tracking performance. We review evidence of the impact of climate policy so far on the three main goals of environmental justice, economic equity, and public accountability. Our analysis highlights important indicators and corresponding data sources to better track the impact of climate policy on equity.

Section 3 applies the Climate Policy Equity Framework to two cases of statewide GHG reduction strategies, one in the area of energy efficiency and the other in renewable energy. Our goal is to demonstrate ways to advance shared equity and climate goals as part of the process of evaluating, designing, and implementing GHG reduction strategies, using the Equity Framework as a guide.

Section 4 builds from the case studies to offer recommendations on strategies to build a social contract as we restructure our economy to lower GHG emissions. These recommendations suggest avenues for creative program design that moves beyond a "lowest common denominator" approach to equity towards a pro-active common-ground equity agenda. We also recommend ways to improve public accountability for achieving equity goals in climate policy.

1. Building Equity in California Climate Policy

1.1 Why Does Equity Matter?

In the context of climate policy, we define equity as the fair distribution of costs and benefits as we make the transition to a low-carbon economy. At a minimum, this equitable transition means not making existing disparities worse and, ideally, striving to reduce disparities.

Improving equity requires the recognition of disparities between different generations, groups, and geographies. Generational disparities are fundamental to the climate crisis: when one generation fails to limit the impacts of its activities on the environment, it unfairly imposes the burden of dealing with negative consequences on the next generation. Group disparities between income classes and racial and ethnic groups also exist in sharp relief in California. While the data on income inequality may be familiar, a range of research also reveals systematic disparities in environmental exposures along the lines of race and ethnicity.[17] Finally, geographic disparities are also important as some regions and neighborhoods in California exhibit a pattern of concentrated poverty and meager access to middle-class employment. Often, environmental inequities overlap with these patterns. For example, in urban neighborhoods with inadequate tree cover, the "heat island" effect increases the risk of heat-related illnesses. Geographic patterns of economic and environmental inequities affect people of color to a greater degree and often mirror existing patterns of residential segregation.[18]

The impact of these disparities is not limited to those at the bottom. Running counter to the traditional view that inequality is necessary for growth, a new wave of research suggests that inequality actually impedes growth. A number of studies by researchers at a variety of institutions—from the Cleveland Federal Reserve to the International Monetary Fund and other international organizations—have found that income inequality undermines economic development, growth, jobs, and political stability.[19] Economic equity can be in everyone's interest.

A similar message is emerging from environmental justice research on the relationship between environmental inequality and environmental quality.[20] In an article aptly titled, "Is Environmental Justice Good for White Folks?" researchers from the University of Massachusetts found that, where class and race disparities in exposure to environmental hazards are higher, pollution burdens are higher for everyone—even those presumably living on "the right side of the tracks."[21] International and national research suggests that this finding is not an anomaly. In short, when environmental hazards concentrate in someone else's backyard, there are simply more problems overall, in everyone's front- and backyards.[22]

Addressing equity is also important to maintain and strengthen the political will for climate policy. The communities that environmental justice organizations represent constitute a significant—and growing—

support base for the state's climate policy. Polls show that low-income communities and communities of color in California are more likely than more-affluent whites to see climate change as a serious threat that requires political action.[23] At the same time, organized labor in California has substantial political influence and can either accelerate or impede climate policy. Labor will engage in supporting climate policy if and when unions and their members see their own future in the low-carbon economy and have a voice at the table when climate policy is designed and implemented. As the experience in other states has shown, when labor is left out or jobs issues are not addressed, unions may oppose climate policy. For the Golden State's electoral politics, the problems of climate change and inequity are under the same spotlight.

All in all, the advancement of equity is not a special interest issue, nor can it be resolved as an afterthought to spurring economic growth or curbing climate change. Addressing equity is challenging but crucial—both for the public good and to sustain political will. It requires first identifying disparities and then finding ways for diverse constituencies to bridge their differences and improve the lot of all. To this end, the following section discusses the key concerns of the main constituencies in California that focus on equity, specifically in the context of climate policy.

The advancement of equity is not a special interest issue, nor can it be resolved as an afterthought to spurring economic growth or curbing climate change. Addressing equity is challenging but crucial—both for the public good and to sustain political will.

1.2 Equity Advocacy in California's Climate Policies

Although the notion that "equity matters" is widely embraced, it does not truly matter in the public square unless there are constituencies making the case for equity in policy arenas. In California, advocates from the environmental justice movement and labor movement have been the strongest political voices for equity, with each bringing different equity considerations to the forefront of climate policy. Understanding the concerns of these constituencies and reviewing their legislative agendas and records is the first step in forging a common equity agenda.

1.2.1 The Environmental Justice Movement

The environmental justice (EJ) movement in California includes groups that advocate for both urban and rural communities where environmental hazards and socioeconomic stressors negatively impact health and quality of life. Key organizations that engage in climate policy in Sacramento from an environmental justice perspective include the California Environmental Justice Alliance (CEJA), an umbrella organization

that brings together diverse EJ groups from the Bay Area, Central Valley, and Southern California, as well as allied equity organizations such as the Greenlining Institute. CEJA and its affiliates have played a key role in advocating for GHG reduction strategies that will not contribute to toxic hotspots and in pushing for greater access to the economic and environmental benefits created by low-carbon growth for low-income and minority communities. These groups' ability to achieve consensus on key equity issues in the climate policy arena has led to new political possibilities and policies.

A central equity concern for EJ groups is whether the GHG reduction strategies in the AB 32 Scoping Plan will alleviate or exacerbate the burden of environmental hazards and related health risks in California's most disadvantaged communities.

An early and ongoing focus of EJ advocates has been strengthening the visibility and representation of EJ issues in the climate policy arena. EJ advocates achieved two important accomplishments in the passing of the landmark Global Warming Solutions Act (AB 32), which elevated EJ concerns in how the state would approach GHG emissions reductions. First, they pushed for the inclusion of two EJ provisions: one mandating that any GHG reduction activities undertaken by the state in compliance with AB 32 not disproportionately impact communities "in regions of the state that have the most significant exposure to air pollution, including, but not limited to, communities with minority populations or low-income populations, or both;'' and another instructing the California Air and Resources Board (CARB) to develop regulatory plans that benefit these communities.[24] The second key victory was the creation of the Environmental Justice Advisory Committee (EJAC) to advise CARB in crafting the Scoping Plan for AB 32. EJAC strongly opposed CARB's inclusion of cap and trade in the AB 32 Scoping Plan but was not able to change CARB's final decision to do so.[25] Since then, EJ advocates have fought for more opportunities to have meaningful influence on state officials. Most recently, with the signing of AB 1288 into law in 2015, two appointees to CARB must be people who work directly with low-income communities and communities of color. This provision is designed to ensure that the equity concerns of the EJ movement are voiced at the highest levels of decision-making for climate and air quality regulation.

A central equity concern for EJ groups is whether the GHG reduction strategies in the AB 32 Scoping Plan will alleviate or exacerbate the burden of environmental hazards and related health risks in California's most disadvantaged communities. This concern has been seen by EJ advocates as the Achilles' heel of the cap-and-trade program. Communities living near polluting facilities are already overburdened with high levels of toxic and criteria air pollutants. These asthma- and cancer-causing "co-pollutants" get emitted alongside GHGs. When polluting facilities are required to reduce GHG emission, they also emit less of these hazardous air pollutants. A cap-and-trade program may reduce overall emissions of GHGs

and co-pollutants, but it may do so unevenly. Rather than require facilities with the highest emissions or most disproportionate impacts to reduce their on-site emissions by investing in pollution abatement technologies or industrial energy efficiency, the California cap-and-trade program permits some facilities to maintain their high emissions or even increase emissions at facilities of their choice. If polluters opt to use pollution allowances or buy offsets instead of reducing pollution at specific facilities, cap and trade can inadvertently increase local levels of GHGs and co-pollutants. For communities that live in toxic hotspots—the areas surrounding polluting facilities that already have a high concentration of pollution—local air quality can worsen (or at least not improve as much as would be possible under a program of mandated reductions), and therefore, public health outcomes may worsen or fail to significantly improve.[26] Two textbook examples of failed cap-and-trade experiments that lack regulatory safeguards indicate this risk is real.[27] Without state controls on emissions trading,[28] EJ advocates have opposed the cap-and-trade program introduced under AB 32, even suing CARB on procedural grounds for its failure to consider EJAC's input.[29] Although the lawsuit was unsuccessful, EJ groups have sought other ways to push California regulators and policymakers to verify that cap and trade is not exacerbating or creating toxic hotspots. Most recently, EJ groups won language in AB 197 to prioritize direct emissions reduction in disadvantaged communities.[30]

EJ groups worked to leverage CARB's cap-and-trade program into a state-administered community benefits fund.

EJ groups also worked with others to leverage CARB's cap-and-trade program into a state-administered community benefits fund. In 2012, EJ groups supported a suite of laws for AB 32 that direct the state to invest a portion of the revenue generated by the cap-and-trade program in disadvantaged communities to maximize economic, environmental, and public health co-benefits of GHG reduction and to protect vulnerable populations against further harm. Together, AB 1532, SB 535, and SB 1018 established the state's Greenhouse Gas Reduction Fund (GGRF), which receives proceeds from the auctioning of allowances.[31] SB 535, in particular, mandates that a minimum 25 percent of GGRF funds be set aside for projects benefiting disadvantaged communities, with at least 10 percent spent within disadvantaged communities. The co-benefits of GHG emission reductions in disadvantaged communities include reducing pollution, improving public health outcomes, creating new jobs, and increasing the availability of clean low-carbon goods and services (e.g., electricity from renewable sources, zero emission vehicles, public transit, and affordable housing).[32]

A core pillar of SB 535 is the CalEnviroScreen: a cumulative impact screening tool used by the California Environmental Protection Agency (CalEPA) to identify the 25-percent most disadvantaged "environmental

justice communities" in the state at the census-tract level. These "EJ communities"—also often called "disadvantaged communities"—will receive an unprecedented pipeline of investment from the state's GGRF.[33] Leading EJ organizations formed the SB 535 Coalition to engage directly with state decision-makers in the implementation of SB 535 (led by APEN, Coalition for Clean Air, Greenlining Institute, and Public Advocates). This coalition has worked to address a number of challenges, including clarifying project evaluation processes to help screen which projects count toward the goals of SB 535 and helping to define meaningful co-benefits (i.e., benefits that significantly address a need identified by low-income residents and households).[34]

Beyond SB 535, EJ groups have worked to expand the benefits of climate policy more broadly, including to specific sectors of the low-carbon economy such as renewable energy, energy efficiency, and transportation. Policies that subsidize the purchase of low-carbon goods and services (e.g., solar power installation, energy efficiency retrofits, electric vehicles) often concentrate in smaller, wealthier segments of the population. EJ advocates refer to these disparities as a "green divide" between those who have the assets to buy low-carbon goods and services and those who do not.[35] The state has long recognized the need to carve out programs that fully subsidize energy efficiency retrofits for low-income utility customers and has two main weatherization programs: the federally funded program administered by the Community Services Department and the utility ratepayer funded low-income Energy Saving Assistance Program. EJ groups have recently applied this approach to other aspects of the low-carbon economy. For example, in 2014, EJ groups co-sponsored SB 1275, the Charge Ahead Initiative, which directs CARB

to use GGRF dollars to create equity programs that increase access to clean transportation in disadvantaged communities. Groups such as the Greenlining Institute are also engaged with the California Public Utilities Commission (CPUC) and California's four investor-owned utilities (IOUs) in the development of minimum requirements for zero emission vehicle (ZEV) charging stations in disadvantaged communities. EJ groups have likewise pushed for renewable energy policies that make solar energy and solar jobs more accessible to members of disadvantaged communities. In 2014, EJ groups supported SB 43, the Green Tariff Shared Renewables Program, which requires California's electric utilities to provide ratepayers the option of purchasing electricity from community shared solar projects to expand solar to those who are not able to install on-site solar generating units on their own houses or buildings for a variety of reasons. In addition to having a special carve-out for low-income customers, SB 43 directs utilities to site community solar projects in disadvantaged communities, which could create career opportunities for local residents.[36] In 2015, EJ groups co-sponsored AB 693, the Multifamily Affordable Housing Solar Roofs Program. This new law provides monetary incentives for solar energy systems installed directly on multifamily affordable homes by third-party owners (solar companies), with a target for combined generating capacity of at least 300 MW). Low-income tenants will receive credits on their utility bills for the solar energy produced by their building.

The EJ movement has also raised concerns about other potentially regressive effects of climate policies. A climate policy is considered regressive when it contributes to increased costs of basic necessities (e.g., transportation fuel, electricity, and water) when consumers with higher income bear less of a cost burden than those with low incomes.[37] For example, a carbon tax on gasoline could push more people towards poverty because poorer people spend a larger percentage of their income on gas and often have longer commutes. In California, where there is no carbon tax, EJ groups have called attention to the potential regressive effects of higher gas prices that might result from the low-carbon fuel standard and the cap-and-trade program adopted by CARB in the AB 32 Scoping Plan.[38] They have also raised concerns about the potential regressive effects of transit-oriented development (TOD) driven by SB 375, the Sustainable Communities and Climate Protection Act of 2008, which could bring increases in housing prices due to gentrification processes.[39] At the same time, EJ groups have been consistent in asking that these regressive impacts be addressed *while supporting* positive action on climate change.

Most recently, EJ groups advocated for a more holistic approach to achieving equity in climate policy through community-led planning for comprehensive green infrastructure investments in disadvantaged communities. In 2016, CEJA co-sponsored AB 2722, the Transformative Climate Communities Act, to build on the CEJA Green Zones Initiative. AB 2722 proposes to use $250 million from the GGRF to fund place-based strategies for environmental cleanup and economic development in the most overburdened communities identified by the CalEnviroScreen. In contrast to the SB 535 approach whereby numerous state agencies administer funds to individual GHG reduction projects, AB 2772 proposes a place-based, comprehensive approach to allocating GGRF money. If passed, this bill would provide money directly to community entities that have developed community-led, neighborhood-level plans for multiple GHG projects.

1.2.2 The Labor Movement

Faced with sharp increases in inequality, the California labor movement has been central to the struggle to help working-class families and has attained significant recent victories in raising local and state minimum wages, mandating paid sick days and family leave, broadening health care for low-wage workers and their children, expanding immigrant rights and opportunities, creating new policies to improve retirement security, and other gains. In addition to these economy-wide issues, unions have engaged in policy struggles in specific industries to protect middle-class jobs or improve low-wage jobs. Labor understands that climate policy is transforming—and will continue to transform—a number of industries whose workers could stand to lose or gain in the process, and this understanding has led affected unions to push for equity in climate policy. Union leaders are likewise acutely aware that when labor's voice is not at the policy table, issues of job quality are often disregarded. Like the EJ community, the labor movement recognizes the long-term climate crisis but also is concerned with who will bear the costs of transition.

The unions most actively engaged in state climate policy are those that represent workers in industries that stand to lose or gain jobs from climate policy measures. In California—where jobs in heavy-emitting industries are small in number and the threat of job loss is muted—the dominant voice of labor has been the building and construction trades unions, which have seen their way clear to support climate policy while advocating for a good jobs agenda. Since the majority of jobs in building new power plants (both conventional and renewable energy), in carrying out energy efficiency retrofits, and in other capital construction projects (such as high-speed rail) are in the skilled construction trades, these unions see more opportunity than threat. This attitude is in stark contrast to many other states where key unionized sectors are more dependent on fossil fuel and heavy manufacturing jobs and building trades unions and industrial unions have taken an active stance against climate policy.[40] However, meeting the stringent reduction targets that the state has set for 2050 will likely necessitate addressing real decline in the oil and gas extraction and refining sectors, which currently generate high-wage union jobs. The thorny issues of "just transition" will have to be confronted.[41]

The main strategy that the construction trades unions use to advance a "clean energy and good jobs" agenda is to advocate for the use of public works construction labor standards on clean energy projects. Construction labor standards allow unionized contractors to compete on the basis of quality as well as costs, rather than simply trying to win a project bid by driving down wages. Construction projects *funded in whole or in part by federal or state public expenditures* are considered "public works" and are required, by state and federal law, to pay "prevailing wages" and to include certified apprentices in their workforce. Prevailing wage laws and apprenticeship standards triggered by public works contracts are the most established strategy for promoting high-quality, career-track jobs. These labor standards can also be incorporated into *privately funded* construction projects governed by a Project Labor Agreement (PLA). PLAs function as pre-hire collective bargaining agreements—typically negotiated between a project owner, construction manager, or general contractor and an appropriate labor organization (usually an area or state Building and Construction Trades Council)—and incorporate standards for prevailing wages,

benefits, apprenticeship training, and working conditions that cover both union and non-union contractors on the project. As a result, these agreements not only benefit unionized workers, but also raise the bar for non-union employers and employees.[42]

The construction trade unions have promoted labor standards either directly or indirectly in a variety of clean energy legislation. The most significant arena of engagement has been the Renewable Portfolio Standard (RPS), one of the key statewide GHG reduction strategies. The State Building and Construction Trades of California, and particularly the International Brotherhood of Electrical Workers union (IBEW), were critical advocates for increasing the RPS to 50 percent in SB 350, the key climate bill passed in 2015. The 50-percent RPS was the strongest element of SB 350, providing a clear mandate and mechanism to achieve the most ambitious renewable energy target in the country and setting in motion the 2030 target a full five years before the previous mandate (20-percent renewables by 2020) was even due.[43] Engagement by the unions in support of the RPS was a "no-brainer" because utility-scale renewables in California are commonly developed under PLAs, union contractors have been successful in capturing the work, and CPUC, the utilities, and the renewable energy developers have come to accept union standards as "business as usual."

The State Building and Construction Trades of California, and particularly the IBEW, were critical advocates for increasing the RPS to 50 percent in SB 350, the key climate bill passed in 2015.

The impact on political support for climate policy has been important. Instead of fearing the transition from fossil fuel to renewables for utility-scale electricity generation, the trades support climate policies in California because they are confident that new energy infrastructure will be union built and provide middle-class jobs for Californians. Similarly, the trades supported Proposition 39 (2012), which closed a tax loophole and provides up to $550 million per year for five years to support energy efficiency projects in K–12 schools in California. Because this funding falls under the public works labor code, projects are covered by regulations such as prevailing wages and apprenticeship requirements. The trades have also been key supporters for Governor Brown's high-speed rail initiative, which is being built under a PLA, as well as his efforts to promote electric vehicles and new mass transit capital investments. The building trades also are key supporters for investments in public infrastructure for climate adaptation. For example, the Operating Engineers and Bay Area building and construction trades councils were among the key supporters of the recently passed bond measure AA (2016), which will fund wetlands restoration and other eco-friendly strategies to address sea-level rise in the Bay Area.[44]

Although a significant victory was achieved with the RPS, in other parts of the clean energy economy the construction trades unions have been less successful, public policy and regulation is not supportive, and

unionized work is rare. The trades have been particularly involved in the energy efficiency arena for a number of years but have not achieved the same level of success as they have in utility-scale renewables.

Instead of fearing the transition from fossil fuel to renewables for utility-scale electricity generation, the trades support climate policies in California because they are confident that new energy infrastructure will be union built and provide middle-class jobs for Californians.

Their main strategy has been to engage in regulatory proceedings related to energy efficiency at the California Energy Commission (CEC) and the California Public Utilities Commission (CPUC), where they advocate for skilled labor and apprenticeship training, responsible contractor standards, and support for the adoption of more advanced technologies in state building codes and in utility incentive programs. In these arenas, the unions have argued that more robust standards for contractors and their work force will ensure proper installation and maintenance for complex and rapidly changing clean energy technologies, often against non-union contractors who contend that lower barriers and costs equal greater participation and more energy savings. Regulators thus far generally rule against the more robust performance and labor standards. For example, CEC recently approved a new 2016 Title 24 Green Code, which rolled back the requirements for widespread deployment of advanced lighting controls in existing buildings in the 2013 Title 24 Green Code, in opposition to the IBEW and its signatory contractors in the National Electrical Contractors Association.[45] The same is true at CPUC, where the unions also advocate, so far unsuccessfully, for the inclusion of labor and contractor standards as requirements for contractor participation in the more than $1 billion in energy efficiency incentives that IOUs administer every year. In these efforts, the unions base their arguments on research showing that such standards help ensure that energy systems in new buildings and energy efficiency retrofits in existing buildings are installed correctly and actually result in real energy savings.[46]

This tension persists between the unionized construction sector, which argues that high performance standards are necessary to ensure correct installation and to cultivate a "high-road" construction industry that invests heavily in workforce training, and the non-union construction sector, which argues for lower standards and lower barriers to participation in energy efficiency incentive programs. To date, regulators have rarely supported higher standards. While a thorough discussion of this issue is beyond the scope of this report, suffice it to say that the equity benefits of higher standards are also lost when CEC and CPUC fail to emphasize the synergy between good jobs, robust skills training through apprenticeship, and the achievement of environmental targets. Nonetheless, the legislature may be growing more supportive of the unions' position. For the first time, SB 350 requires that CEC adopt, implement, and enforce responsible contractor policies "to ensure that retrofits meet high-quality performance

standards and reduce energy savings lost or forgone due to poor-quality workmanship, and to establish consumer protection guidelines for energy efficiency products and services."[47]

Beyond the building and construction trades, a number of unions whose jobs and industries are not significantly affected by climate change policy are also pushing for bold GHG reduction, and many of these unions advocated for SB 350 and for SB 32. The most active non-building trades unions—including the Service Employees International Union (SEIU); the American Federation of State, County and Municipal Employees; the California Nurses Association; the California Federation of Teachers; and a number of individual locals and central labor councils—have all recently passed resolutions to voice their public support of climate policy.[48] These unions and other organizations that represent workers whose members are affected by close proximity to environmental hazards increasingly view environmental justice organizations as partners in solving a variety of public health and environmental problems, like toxic pollution and air quality.[49] At its 2016 Biennial Convention, the California Labor Federation, which represents 2.1 million union members from almost all the unions in the state, passed a climate resolution committing the Federation to educate affiliated unions and their members on climate change and policy and "to engage in the passage and implementation of key environmental policies with a focus on ensuring good job creation and environmental sustainability."[50] These actions are likely to lead to greater involvement in state climate legislation in the coming years.

1.2.3 Bridging Community and Labor Concerns: Economic Equity Organizations and Green Jobs

Beyond labor unions, a number of organizations committed to economic equity have turned their attention to clean energy development. Working at the intersection of labor and community, these

organizations elevate labor's concerns for family-supporting, career-track jobs and seek to broaden access to these jobs for disadvantaged workers.[51] In addition to the early pioneering work by Green for All, other economic equity organizations like the Emerald Cities Collaborative, affiliates of the Partnership for Working Families, and others such as Strategic Concepts in Organizing and Policy Education (SCOPE) in South Los Angeles have developed multiple local and regional campaigns to create pathways out of poverty in the new clean energy economy as part of climate policy. Drawing from successful labor–community alliances in other public infrastructure developments, these advocates for green jobs have pushed for Community Workforce Agreements (CWAs), which have emerged as best practices for recruiting low-income workers into construction careers and establishing strong job quality standards in publicly funded or subsidized construction projects.

Drawing from successful labor–community alliances in other public infrastructure developments, these advocates for green jobs have pushed for Community Workforce Agreements, which have emerged as best practices for recruiting low-income workers into construction careers and establishing strong job quality standards in publicly funded or subsidized construction projects.

A Community Workforce Agreement consists of a PLA (described on page 30) that includes a targeted or local hire provision designed to bring low-income or otherwise disadvantaged workers into construction careers. The most successful CWAs have strong partnerships with pre-apprenticeship training programs that coordinate worker recruitment/screening and link workers with support services to help participants successfully enter apprenticeship programs.[52] The requirements for prevailing wage and apprenticeship standards provide the architecture to improve job access for entry-level workers into middle-class careers in the construction trades by creating more openings in the apprenticeship programs; the targeted hiring agreements then ensure inclusion of disadvantaged workers as those apprentice openings are filled. Often, the CWA hiring provisions are implemented with the participation of local pre-apprenticeship programs linked to local trades councils and in partnership with the local One-Stop Career Centers or community-based organizations, which serve as an entry point for workers.

Unions and economic justice organizations have successfully won and implemented CWAs for major public works projects in many localities and jurisdictions.[53] These coalitions have had the most success at the municipal level, but CWAs have been established in a variety of contexts, using a range of mechanisms, from collective bargaining negotiations in individual projects to CWA policies covering all public

works in a locality. Although CWAs are less common in the clean energy arena than in large-scale local development projects, a number of economic equity organizations and the coalitions they anchor are increasingly focusing on the clean energy and energy efficiency arenas in both local and state projects. One example of a CWA in California in the clean transportation arena is the High Speed Rail Authority's CWA, negotiated with the State Building and Construction Trades of California, which includes a strong targeted hire provision to broaden work opportunities for specified categories of disadvantaged workers and disadvantaged communities.[54]

These economic equity organizations also go beyond CWAs, which address only the construction phase of development projects, to secure agreements about other community benefits from the developer. These more comprehensive Community Benefit Agreements (CBAs) often include local hiring and living wage agreements for ongoing operations work once the construction phase is complete, as well as other varied benefits such as carve-outs for local minority-owned businesses, affordable housing, and pollution mitigation.[55] As such, CBAs are also a form of community-level planning, a key element of effective participation and voice that is central to public accountability and a crucial articulated value of the environmental justice movement. California boasts of a number of examples of comprehensive CBAs, including the CBA governing the redevelopment of the Oakland Army base and the CBA covering the Los Angeles International Airport, which encompasses a wide range of operations jobs.[56]

Economic equity organizations so far have focused mostly on local campaigns and projects. However, they are increasingly turning their attention to state policy, as well. Their ability to bridge community and labor interests, build broad coalitions, and successfully implement projects speaks to their importance and potential role in building a social contract for the transition to a low-carbon economy.

2. The Climate Policy Equity Framework

The implementation of existing state climate policy—and the creation of future policy—offers significant opportunities to help California's most disadvantaged communities and build good jobs in a low-carbon economy. Advocacy within the labor and environmental justice movements shows that equity has multiple dimensions. In this section, we present the Climate Policy Equity Framework to serve as a guidepost for spelling out these multiple equity goals and tracking progress towards them. This section specifies goals, identifies specific criteria to meet these goals, and uses available evidence to assess success to date and ongoing challenges. For some criteria, this assessment is not yet possible due to lack of data; when this is the case, we recommend metrics and data that should be collected and made publicly available.

The Climate Policy Equity Framework is organized by three principles: environmental justice, economic equity, and public accountability. As shown in Table 1, these three principles reaffirm the need for equity across generations, geographies, and groups (see Section 1.1, "Why Does Equity Matter?"). The goals listed under each principle illustrate the outcomes advocated by the labor and environmental justice movements (see Section 1.2, "Equity Advocacy in California's Climate Policies") as well as the need for greater accountability in climate policy.

Table 1. The Climate Policy Equity Framework

Principle 1.	**ENVIRONMENTAL JUSTICE**
Equity Goals:	• Reduced environmental and public health risks to disadvantaged communities. • Expanded access to benefits in disadvantaged communities. • Protection from adverse economic consequences for disadvantaged communities.
Principle 2.	**ECONOMIC EQUITY**
Equity Goals:	• High-quality, career-track jobs in clean economic growth sectors. • Just transitions for workers and communities in sectors at risk of decline due to climate policy.
Principle 3.	**PUBLIC ACCOUNTABILITY**
Equity Goals:	• Enhanced participation in public decision-making. • Transparent monitoring of equity outcomes. • Continuous learning and improvement.

2.1 Using the Climate Policy Equity Framework to Assess Progress Towards Equity Goals

In this section, we present specific criteria for each of the three main principles of environmental justice, economic justice, and public accountability. Together, these criteria can be adapted into a "screening tool" to develop the equity dimensions of proposed legislation or regulation. Likewise, the criteria can provide the foundation for an evaluation or scorecard to assess how a particular climate policy, program, or project has impacted key equity outcomes.[57] We next review how existing California climate policies have performed so far on equity goals. Where appropriate, we also highlight data gaps and suggest indicators and metrics.

The implementation of existing state climate policy—and the creation of future policy—offers significant opportunities to help California's most disadvantaged communities and build good jobs in a low-carbon economy.

2.2 Environmental Justice: Criteria, Progress, and Challenges

Criteria for the environmental justice principle of our Climate Policy Equity Framework stress the need for new policies that, at the very least, do not worsen current disparities and hopefully improve outcomes in the most polluted and socioeconomically disadvantaged communities. Identifying the communities in question has been an ongoing dilemma in both academic and policy circles. For years, researchers have grappled with complex questions about how to identify the communities suffering from environmental injustice.[58] Fortunately, there is now broader agreement on how to identify those communities: both the Environmental Justice Screening Method (EJSM), pioneered by several of the authors of this report, and CalEnviroScreen, developed by the state's Office of Environmental Health and Hazard Assessment (OEHHA), combine pollution exposure and socioeconomic status to tag a set of communities as meriting special attention to enhance current environmental conditions. In this report, we use the term "disadvantaged communities" as a general description of environmental justice communities. While we do not weigh in on which specific communities should be given this designation in policy implementation, CalEnviroScreen is being used for that designation for various policy purposes, including the allocation of funds from cap and trade.

Our environmental justice criteria are organized into three categories: reducing risks in EJ communities; enhancing benefits in those communities; and improving resilience in those communities.

Table 2. Environmental Justice

Principle 1. ENVIRONMENTAL JUSTICE	
No.	Criteria
Goal:	Reduced environmental and public health risks to disadvantaged communities.
EJ1	Decreases pollution regionally *and* locally in toxic hotspots.
EJ2	Improves public health outcomes associated with pollution exposure and climate vulnerability.
Goal:	Expanded access to benefits in disadvantaged communities.
EJ3	Expands access to goods and services arising from clean, low-carbon development (e.g., renewable energy, low-carbon mobility).
Goal:	Protection from adverse economic consequences for disadvantaged communities.
EJ4	Avoids raising the cost of electricity, transportation fuel, and water for disadvantaged communities.
EJ5	Increases economic and social resilience to gentrification-induced displacement created by low-carbon urban development.

2.2.1 Reduced Environmental and Public Health Risks to Disadvantaged Communities

Climate policy in California can help reduce the environmental and public health risks created by emissions of GHGs and co-pollutants. For example, CARB forecasts that the Low-Carbon Fuel Standard (LCFS)—adopted under the AB 32 Scoping Plan—could result in nearly 100 lives saved by displacing harmful fuels with cleaner fuels by 2020.[59] These findings complement research by the American Lung Association (ALA) and the Environmental Defense Fund (EDF) estimating that the LCFS could save more than 400 lives and avoid more than $23 billion in societal damages, including $8.3 billion related to respiratory health impacts, by 2025.[60] The ALA/EDF report also estimates that a 100-percent electric fleet would remove 275 tons of criteria pollutants every day and prevent 10,000 asthma attacks every year, avoiding $13 billion in health, climate, and other societal damages annually.

Despite these predicted benefits, some GHG reduction strategies may undermine this goal, particularly if market-based strategies, such as cap and trade, do not effectively incentivize reductions in industrial- and fuel-based GHG emissions and their co-pollutants in communities that are disproportionately affected by both stationary and mobile sources. Therefore, it is critical to evaluate whether the predicted benefits of California's diverse arsenal of GHG reduction strategies are, in fact, being realized at multiple levels (local, regional, and statewide), including localized impacts on disadvantaged communities. For example, the LCFS requires transportation fuel producers to progressively meet more stringent carbon intensity standards by using low-carbon fuels such as biofuels. However, more research is needed to

understand how the siting of new biorefineries in heavily polluted rural areas like the Central Valley will impact nearby communities due to increased emissions from processing biofuels—especially those that use municipal waste as a feedstock—and from the additional truck trips to transport biofuels to market.

Another pressing concern is that public health benefits of reducing GHG emissions may go unrealized due to emissions trading. For example, consider a market trade where emissions reductions in areas with smaller populations occur because they are cheaper than reducing emissions in areas with larger populations; the same overall reduction in GHG is obtained, but disadvantaged communities living near large emitters may see minor or no improvements in co-pollutants and immediate public health. A UC Berkeley study shows that allowing regulated polluters to use offsets to meet AB 32 could have a significant impact on levels of criteria air quality pollutants in California. The study predicts that, although offsets may reduce methane and toxic gas emissions like benzene in rural areas throughout the state, levels of nitrogen oxide (NOx) emissions would be higher because polluters like refineries would be offsetting their local NOx emissions by buying offsets from methane-reducing projects in the agriculture, landfill, and forestry sectors. The unintended consequence for communities living near the refinery would be greater exposure to harmful NOx pollution.[61] Again, this is a predictive model; data on actual impacts are not yet available. CARB appears to have recognized this potential problem, if not fully accounting for it in the final implementation plan.[62]

Climate policy in California can help reduce the environmental and public health risks created by emissions of GHGs and co-pollutants . . . but market-based strategies, such as cap and trade, may not effectively incentivize reductions in industrial- and fuel-based GHG emissions and their co-pollutants in communities that are disproportionately affected.

CARB is working to determine whether cap and trade is causing adverse impacts at the neighborhood level through an Adaptive Management Plan that proposes to evaluate the distribution of emissions over time at individual cap-and-trade facilities.[63] CARB's preliminary approach to developing this plan includes a publicly available interactive GHG Emissions Mapping tool that monitors GHG emission changes at individual facilities, in California communities, and across industrial sectors. Using this tool, CARB can monitor emissions in disadvantaged communities living in close proximity to one or more of these facilities. If pollution has worsened, CARB can respond with amendments to cap-and-trade regulations and related air quality permitting rules.

However, CARB's monitoring tool does not include information on facility-level co-pollutants nor information on how emissions trading works in practice. Since GHG emissions are usually accompanied by

releases of co-pollutants, an accurate evaluation of cap and trade requires tracking not only facility-level GHG emissions, but also facility-level toxic and criteria air pollutants. Data on emissions of GHGs and co-pollutants already exist but require linking facility-level identifiers for these separate data sets—an onerous task for outside researchers who must guess at the connections but something that would be relatively straightforward if mandated in CARB's data management. This information would enable evaluation of where cap and trade is improving the level of co-pollutant emissions that cause adverse health effects in communities that are more vulnerable to negative health and economic consequences.

To assess whether the cap-and-trade system is creating or amplifying the disproportionate impact of toxic and criteria air pollutants in already overburdened communities, several sources of information must be made publically available in a form that facilitates integration of key data into the same analysis, for example:

1. **Access to current facility-based emissions for GHGs, criteria air pollutants, and air toxics:**
   The annual summary of GHG emissions by facility is available for 2011–2014[64] (2011 is the first year of permit trading for point source facilities). For years prior to 2011, data is available (back to 2008), but differences in reporting requirements implemented over time complicate the temporal analysis, particularly for years 2008–2010. Harmonization of temporal data is crucial to assessing equity impacts of programs such as cap and trade and offsets.

2. **Access to data that links GHG emissions and co-pollutant emissions:**
   Analysis of toxic hotspots requires matching data sets to link GHG records to annual reporting of co-pollutant emissions by each facility using the state toxic air emissions inventory (CIEDARS). This undertaking is complicated by the fact that these two databases lack a common facility identifier. There are also inconsistencies in other facility information between these two data sources, including facility name, address, and emissions reporting years.

3. **Information on trades and offsets:**
   Allowance auctions and use of offsets by regulated facilities is now closely guarded, but being able to track auction purchases and link auction buyers and sellers—to see where GHG and co-pollutant reductions are occurring or being avoided—is crucial to any equity analysis.

2.2.2 Expanded Access to Benefits in Disadvantaged Communities

The second environmental justice goal for climate policy is to expand access to the benefits of GHG reduction strategies in disadvantaged communities. The cap-and-trade program has generated new investment in disadvantaged communities under the requirements of SB 535. For fiscal years 2012/13 through 2015/16, investments totaled approximately $2.374 billion, which are allocated across five investment categories as stipulated by AB 1532: energy; low-carbon freight and transportation; natural resource

conservation; sustainable infrastructure projects (including housing); and waste management. The California State Legislative Office has estimated that the cap-and-trade program will generate between $12 billion and $45 billion from 2012 to 2020,[65] although recent auctions have generated much less revenue than expected.[66] Funded projects promise a range of co-benefits, including improved public health, better air quality, drought relief, reduced energy costs, economic and workforce development, and infrastructure upgrades. However, tracking the co-benefits of GGRF investments requires more consistent data reporting from project recipients and agencies, which is currently limited.

Expanding access to benefits in disadvantaged communities has also occurred through policies that subsidize clean low-carbon goods and services for low- and middle-income families. Since 2006, American households have received more than $18 billion in federal income tax credits to weatherize their homes, install solar panels, and buy hybrid and electric vehicles. However, these credits have mostly gone to higher-income households.[67] Closing what EJ groups call "the green divide" requires a fair distribution of public resources and utility ratepayer resources, which are an important funding source for a variety of incentives, so that the growth of goods and services in the emerging low-carbon economy is not limited to wealthy groups and coming at the expense of less-advantaged groups. Traditionally, this leveling has been achieved through programs that have carve-outs for low-income customer segments.

In the electricity sector, expanding access to low-carbon goods and services has occurred through a number of mechanisms. Under the direction of the California Public Utilities Commission (CPUC), investor-owned utilities (IOUs) have supported low-income consumers by administering the California Alternate Rates for Energy (CARE) program and the Energy Savings Assistance Program (ESAP). CARE enrolls low-income ratepayers to receive a 30- to 35-percent discount on their electric bills. Participants are also eligible for no-cost weatherization services through ESAP. For the 2012–2014 program cycle, CPUC adopted a total ESAP budget of $1.1 billion, or approximately $370 million annually, funded by ratepayers through the Public Purpose Program (PPP) charge. For the year 2012, this money

funded weatherization for approximately 270,000 homes statewide.[68] The Community Services Department's weatherization program has also been an important source for low-income weatherization services.[69]

As for solar energy, since 2007 residential solar has expanded massively in California due to a unique set of federal and state policies.[70] Unsurprisingly, the rooftop portion of that expansion has so far concentrated in affluent populations that own homes and can afford the investment required to install solar panels.[71] In addition to direct subsidies to homeowners for installing solar, net energy metering (NEM) provides an indirect subsidy for residential solar by crediting homeowners, at the full retail rate, for the excess electricity they send back to the grid. This arrangement lowers the total cost (installation plus monthly utility bill) of rooftop solar to consumers and particularly favors larger residential energy users, who are generally wealthier. Under net-energy metering (NEM), larger residential energy users can recoup the installation cost of rooftop solar more quickly, because tiered utility rates give them a larger credit on their utility bills for excess solar electricity that goes back into the grid. [72] In contrast, smaller energy users who pay a lower electricity rate also receive a lower credit for their excess solar electricity. [73] This differential allows higher energy users (who are generally more affluent) to recoup the costs of solar installation more quickly. As a result, households from disadvantaged communities have much lower participation rates than wealthier households in solar incentive programs.[74]

Closing what EJ groups call "the green divide" requires a fair distribution of public resources and utility ratepayer resources, which are important funding sources for a variety of incentives. The growth of goods and services in the emerging low-carbon economy cannot be limited to wealthy groups and come at the expense of less-advantaged groups.

Rooftop solar installations also remain out of reach for those who rent their homes, have bad credit, or own homes with roofs that are not appropriate for solar panels. The implementation of recent laws will help to address this disparity in access to solar energy for low-income groups. AB 693, the Multifamily Affordable Housing Solar Roofs Program, will bring solar to the roofs of many low-income renters through a new program called Solar CARE. The law dedicates $100 million per year to fund free on-site solar installation to low-income tenants of multifamily affordable housing projects, helping to lower energy bills for these renters. Given that about half of all homes and businesses cannot host a rooftop system,[75] increasing access to the benefits of solar energy can also occur through utility-scale and community-shared solar programs—a topic we discuss further on in Section 3.2, "Solar Energy Deployment to Close the Climate Gap and Grow Family-Supporting, Career-Track Jobs." SB 43, the Green Tariff Shared

Renewables Program, will expand solar energy options for those who cannot host on-site rooftop solar systems through community-shared solar programs sited in disadvantaged communities. Some promising initiatives are currently being implemented, although it is too soon to assess the impacts. For example, a Community Solar Program now in development at the Los Angeles Department of Water and Power (LADWP) will give customers the option to subscribe to solar produced by panels installed on municipal property at locked-in energy rates that will not be subject to the proposed annual rate increase of about 3 percent.

In electric transportation, new equity programs promise to address one of the more extreme disparities in access to low-carbon goods and services in the state. Roughly a third of the nation's 150,000 electric cars have been purchased in California, thanks largely to the Clean Vehicle Rebate Project. However, those in the state's top income quintile have received about 90% of all credits for electric vehicles.[76] SB 1275 created the Charge Ahead California Initiative, which will establish a variety of alternative transportation programs targeted at disadvantaged communities, including: EV car-sharing programs; low-income financing options for EVs; rebates for replacing gas-guzzling "clunkers" with new or used hybrid, plug-in hybrid, or electric vehicles; and vouchers for transit and car sharing.[77] All of these initiatives aim to help meet Governor Brown's 2025 goal for 1.5 million zero emission vehicles (ZEVs) on California's roads by 2025 and will do so in a more equitable fashion than past programs.

Across all these sectors, expanded access to new employment and training opportunities for economic activities associated with GHG reduction is a significant concern for disadvantaged communities, a topic we flag here but address in more detail in Section 2.3, "Economic Equity: Criteria, Progress and Challenges."

2.2.3 Protection from Negative Economic Consequences for Disadvantaged Communities

From an equity perspective, climate policies should not increase the cost of basic necessities like electricity, transportation fuel, or water, nor should they contribute to the displacement of residents in disadvantaged neighborhoods targeted by investments in sustainable community planning efforts. Some protective measures are already in place to offset the regressive effects of California's climate policies. For example, the compliance costs of the cap-and-trade program resulting from regulated entities' purchase of carbon allowances or investments to lower their own GHG emissions are likely to be passed on to consumers, creating a cost burden that disproportionately impacts low-income Californians. To compensate, investment from the GGRF will return money directly to an IOU's residential customers in the form of a dividend or "climate credit" that appears on the ratepayer's utility bill. These credits will begin with natural gas in 2016 and expand progressively. Climate credits combined with existing rate regulations and the CARE program will help protect low-income consumers from bearing a disproportionate increase in their utility bills attributed to the cap-and-trade program. In 2016, UCLA researchers calculated that cap and trade would cost each disadvantaged household $15 for that year on average but that these households would receive approximately $65 in climate credits, creating a net positive financial impact of $50.[78]

In the transportation sector, some regressive effects of climate policy can be more difficult to detect and offset than others. For example, SB 375 promotes higher-density urban development around major transit stops in order to reduce emissions by lowering vehicle-miles traveled from passenger vehicles. Increased development around transit areas could drive up land values and decrease the availability of affordable housing options. Gentrification-induced displacement from climate policy could occur when formerly poor or low-income neighborhoods become attractive to wealthier groups because of the increased access to new low-carbon goods, services, or resources.[79] Research shows that gentrification is more likely in areas well served by mass transit with older housing stocks.[80] If climate-related policies drive up the cost of local housing, goods, and services, then rather than being positioned to enjoy these benefits, over time the original residents will be pushed out of the neighborhood. This situation is not only problematic from an equity perspective; it can also backfire on climate goals by forcing out local residents who are actually transit-dependent in favor of those who have higher incomes and are more occasional users.[81]

To offset this risk, climate policy can improve the capacity of neighborhood residents to avoid displacement from gentrification resulting from GHG reduction strategies. The policy tools typically used to accomplish this goal—such as inclusionary zoning, affordable housing requirements, housing trust funds, and other related tools—are often not considered part of "climate policy," but they should be. One promising approach used by the Strategic Growth Council (SGC)—the cabinet-level committee responsible for implementing SB 375, administering the Sustainable Communities Program, and advising the Department of Finance on the GGRF Investment Plan—is to make anti-displacement strategies one consideration in administering its allocation of cap-and-trade dollars for the Affordable Housing and Sustainable Communities (AHSC) Program. Such initiatives to increase community-level resilience may become a crucial element of a social contract for the transition to a low-carbon economy.

2.3 Economic Equity: Criteria, Progress, and Challenges

Climate policy will continue to transform jobs in the industries that supply our energy, run our transportation systems, and affect energy use in our buildings, homes, and industries. Ensuring economic equity as we manage these changes is a big task, and it will get bigger as California's GHG reduction targets become more stringent. For expanding sectors, the core criteria for economic equity address whether or not newly created clean energy jobs offer family-supporting wages and benefits, whether or not workers from low-income communities of color can gain access to these good jobs, and whether or not workers, their families, and their communities will find support during the transition, in the face of job loss and plant closures in carbon-intensive industries like oil extraction and refining and some manufacturing, which have been key industries and critical generators of middle-class jobs in our state and national economy.

Table 3: Economic Equity

Principle 2. ECONOMIC EQUITY	
No.	Criteria
Goal:	High-quality, career-track jobs in clean economic growth sectors.
EE1	Generates jobs with family-supporting wages, benefits, career paths, and safe and healthy working conditions.
EE2	Supports prevailing wage and skilled workforce standards in the construction industry.
EE3	Increases access to career-track jobs for workers from disadvantaged communities.
Goal:	Just transitions for workers and communities in sectors at risk of decline due to climate policy.
EE4	Provides income supports, retraining, and job placement into comparable jobs for displaced workers or bridges to retirement for older workers.
EE5	Supports economic development for communities affected by plant closures and sector shrinking.

2.3.1 High-Quality, Career-Track Jobs in Clean Economic Growth Sectors

A full reckoning of the job losses and gains resulting from California's climate policy is not yet possible, as this assessment would entail the impact of changes in production, changes in prices of key commodities (such as electricity or transportation fuel), and their interactive effects as they ripple through the economy.[82] However, a review of available evidence affirms that California's climate policies have resulted in modest positive net job creation (growth minus decline) and significant job growth in specific segments of the clean energy economy, particularly in renewable energy generation.

Climate policy is causing the "greening" of jobs, rather than creating new and different "green jobs."

In assessing the likely overall job impact, it is important to note that the energy-producing sectors undergoing major transition—such as power generation and distribution and fossil fuel extraction and refining—represent a small slice of total employment, limiting the impact of both potential job loss and growth on the overall economy. The main energy consuming sectors, such as transportation, building and construction, and manufacturing, will also undergo transition, but much of this change will entail transformation, rather than elimination of occupations, as electricians install more efficient lighting or auto-repair mechanics work on electric, rather than gas, vehicles. It is thus more accurate to say that climate policy is causing the "greening" of jobs, rather than creating new and different "green jobs."[83] The ripple effects of the greening of jobs on the rest of the economy are therefore limited, which is why the dire predictions of economic disaster voiced by climate policy opponents have not come to pass.

Researchers have traced the impact of climate policies on job growth in key sectors such as renewable power generation and energy efficiency. These largely comprise jobs in the construction sector as new generating facilities and energy-efficient equipment are installed (with much a smaller number of jobs in operations and maintenance after installation is complete).[84] In the electricity generation sector, the California Renewable Portfolio Standard (RPS) has been the main driver of investments in utility-scale renewables, generating about 33,000 direct jobs from the construction of renewable energy facilities between 2002 and 2015.[85] Direct job growth is predicted to expand further under the 50-percent RPS by 2030 mandated in SB 350.[86] Information about the impact of climate policy on energy efficiency and transportation jobs is not yet reliable.

Much of the attention to jobs has been focused on net growth in jobs, but one of the biggest issues for equity—and for the future of the middle class in California—is job quality. In this regard, there is evidence that job growth induced by climate policy has not always led to high-quality, career-track employment opportunities. Jobs in clean energy are subject to the same market forces as other sectors of the economy, with professional jobs generally associated with family-supporting wages and pathways into a stable career, but blue-collar, middle- and lower-skilled jobs continue to face downward wage pressure, unless they are unionized. The proliferation of low-wage jobs in California highlights the need to track not only job growth and loss, but also job quality: wages, benefits, working conditions, and career paths that offer skill acquisition linked to wage increases over time. Climate policy cannot be expected to be the "silver bullet" that solves the state's low-wage job problem, but likewise, it should not contribute to exacerbating inequality in the labor market.

The state's track record for generating good career-track jobs is mixed. Utility-scale renewables projects in California (>20 megawatt generation facilities, including solar, that sell wholesale electricity to energy providers) have provided unionized careers in the skilled construction trades, proving that political support for the RPS from the building trades unions has had a big pay-off for workers. A study of jobs in utility-scale renewables in California found that these blue-collar jobs pay on average about $37 per hour, with a benefit package including health, pension, and training equal to another $18 per hour.[87] Entry into these jobs is through earn-while-you-learn, state-certified apprenticeship training programs where workers gain broad occupational skills that can be used not only in renewable energy projects, but also across the construction field where their craft is needed. An apprentice electrician's mean hourly wage is $23.96 per hour plus benefits with wage increases tied to skill acquisition as trainees move through a five-year apprenticeship program.[88] After graduation, electricians receive a middle-class journey wage. Laborers, carpenters, ironworkers, sheet metal workers, and others follow similar trajectories.

Climate policy cannot be expected to be the "silver bullet" that solves the state's low-wage job problem, but likewise, it should not contribute to exacerbating inequality in the labor market.

By contrast, labor and other advocates have not been able to influence policies to require labor standards on distributed solar. The smaller-scale (<1 MW) residential and commercial rooftop solar market is almost all non-union, wages are much lower, and career paths are lacking. The California Occupational Guides report that wages for solar installers range from $11.50 to $21.00 per hour.[89] The Bureau of Labor Statistics (BLS) Occupational Employment Statistics survey shows a median hourly wage of $20.81,[90] while industry data presents average hourly wages in the $20 to $24 range and an acknowledgement that "a distinct career progression has yet to form for photovoltaic installers."[91] Our review of job postings also found lower wages for solar installers, ranging from $10 to $21 per hour.[92] These lower wages are not an inevitable characteristic of distributed solar, but rather a consequence of the lack of labor standards and/or unionization.

The bottom line is that solar jobs are mostly blue-collar construction jobs. Like other construction jobs, they are a mix: some good jobs with career paths based on skills development through apprenticeship in the unionized construction labor market (e.g., utility-scale renewable generation) and many low-wage jobs without career trajectories in residential rooftop solar. Our economic equity criteria provides clear direction to policymakers in this arena: it is important across the market to have labor standards, including the particular labor standards that govern the construction labor market, such as prevailing wages and use of workers enrolled in state-certified apprenticeship programs.

For the energy efficiency sector, there is very little specific information on wages and benefits for workers engaged in retrofit projects, as government construction industry data does not differentiate energy

efficiency work, and in general, energy efficiency programs do not track job quality. So far, Proposition 39, which allocates public funds for energy efficiency retrofit projects in K–12 schools, is the only program that requires jobs reporting. As a public works program, Prop. 39 is subject to prevailing wage laws and apprenticeship standards, ensuring the creation of good career-track jobs. The same standards are not in place for low-income weatherization work funded by ratepayer or government programs, where some data is available to document low wages and lack of career paths.[93] One exception is the Los Angeles Department of Water and Power (LADWP), the largest municipal utility in the United States, which sets a wage floor and provides pre-apprenticeship skills training and jobs leading to careers with utilities or union construction contractors. (We highlight this program as one of the case studies in Section 3 of this report, "Finding Common Ground for Advancing Equity in Climate Policy.") The examples of Prop. 39 school retrofits and residential weatherization programs follow a pattern of disparity that is similar to construction jobs in the solar industry and the more general construction market: higher-wage jobs with benefits, training, and career paths in the public and unionized segments of the construction industry; and predominantly low-wage jobs with lower skill requirements in residential and small commercial segments. Without specific intervention, the same market forces that produce wage disparities and inequality in the economy as a whole can be expected to impact the emergent low-carbon industry sectors.

Without specific intervention, the same market forces that produce wage disparities and inequality in the economy as a whole can be expected to impact the emergent low-carbon industry sectors.

In addition to the equity criteria on job quality standards, meeting the equity goal of "high-quality, career-track jobs in clean economic growth sectors" also requires improved access to career-track jobs for workers from disadvantaged communities. The promise of a growing clean energy economy brings with it great hopes for an inclusive clean energy sector that can provide jobs for disadvantaged workers, offering a vision for pathways out of poverty that is attractive to politicians and social movement organizations alike. In principle, California's substantial investments in renewables, energy efficiency, and other low-carbon industries offer a promising opportunity to build middle-class career pathways for disadvantaged workers and other jobseekers with barriers to employment. While the historic deficits in education, training preparation, and job opportunities that plague low-income communities and communities of color cannot be solved comprehensively by climate policy, investments in low-carbon economic development should incentivize and broaden opportunities.

To date, very little data is available to reveal the demographic and geographic profile of clean energy and energy efficiency jobs. Given the likelihood that these jobs are shaped by the same forces in other economic sectors, jobs in low-carbon industries are likely to follow a pattern: a greater proportion of

white Californians work in higher-paid professional occupations, while more workers of color are employed in lower-wage jobs. In one corner of the low-carbon economy, a clearer picture of job access may come from data tracking the job impacts of Prop. 39. For the first time, geographic data on employee zip codes will be available. This information is the first step in determining whether or not workers from disadvantaged communities have been hired, at least in urban areas where zip codes can partially capture levels of disadvantage. Gathering accurate data to assess the scale and scope of disparities in access to jobs in renewable energy and energy efficiency is not easy, but it's critical to designing effective policy to reverse this trend.

Improving job access requires specific labor market interventions to counteract entrenched patterns of wage inequality. To broaden opportunities into career-track, green jobs for historically excluded workers, a two-pronged strategy is generally required to (1) develop a pool of qualified workers from disadvantaged communities (i.e., foster a more inclusive supply of prepared workers) and (2) change hiring practices to expand access to opportunities for this pool of workers (i.e., increase the demand for qualified workers from disadvantaged communities).[94] Both strategies must be tailored to the specific characteristics of the industry and occupation where job growth is occurring. For example, improving access to professional jobs in low-carbon industries hinges on inclusion strategies that help students from disadvantaged communities gain the college education required for entry into these jobs and changes in employer hiring practices to ensure adequate outreach and non-discrimination.

These efforts bring together local building trades unions, construction contracting firms, economic equity organizations, and community leaders who can join forces to leverage construction investments into career-training opportunities for workers in local disadvantaged communities.

To improve access to good jobs in clean energy construction, one model with a proven track record involves instituting targeted hire goals and expanding the use of contractors whose workers participate in state-certified apprenticeship programs. As discussed earlier, Project Labor Agreements (PLAs) and Community Workforce Agreements (CWAs) have been widely and successfully used to expand opportunities for workers with historically high barriers to employment. There are many examples of successful local or targeted hire programs in public works projects throughout the state. These efforts bring together local building trades unions, construction contracting firms, economic equity organizations, and community leaders who can join forces to leverage construction investments into career-training opportunities for workers in local disadvantaged communities.[95]

There are still relatively few examples of climate-mitigation investments that have adopted PLAs and CWAs to ensure quality jobs and expand access for disadvantaged workers. In general, investor-owned utility (IOU) and state agency programs that fund or subsidize energy efficiency and solar energy have not used these tried-and-true practices to capture the full potential to expand access to career-track jobs. For example, IOUs spend more than $30 million per year on workforce education and training, but this investment is disconnected from the jobs created by their much larger investment in energy efficiency retrofits, where jobs are actually generated. The California Community Service Department (CSD), which funds low-income weatherization, likewise has not yet captured the full potential of their program's jobs and training benefits, although they are in the process of redesigning their GGRF-funded programs to incorporate elements of a CWA. CSD does have a current contract for its solar program with the non-profit organization GRID Alternatives, which trains volunteers from low-income communities to work as installers, with the idea that volunteer experience will help entry-level workers access more professional training programs and certifications.[96] Nonetheless, anecdotal reports from GRID Alternatives indicate that only a small proportion of volunteers in the Los Angeles region have gone on to find long-term, higher-wage employment.[97]

To improve on this outcome, the state will need to learn from examples like LADWP's low-income weatherization program. As we explain in more detail further on, that effort incorporates an earn-while-you-learn strategy that serves as a pathway into blue-collar careers in the utility. A number of the utility-scale renewable developments, which include prevailing wages and apprenticeship standards, have also explicitly included targeted hire goals; others have created pre-apprentice job classifications (known as "construction wireman" for the electrical trade) that serve as a pathway into apprenticeship.

2.3.2 Just Transitions for Workers and Communities in Sectors at Risk of Decline Due to Climate Policy

The second major goal of economic equity is to protect workers, their families, and their communities in sectors that may face decline from GHG reduction policies. In these corners of the economy, comprehensive support strategies for workers and communities are necessary to ensure just transitions, so that they do not bear more than their share of the costs of transition. Previous experience has led many trade unionists and jobs advocates to be wary of the term "just transition," sometimes called "just an invitation to a fancy funeral."[98] A recent report by the Labor Network for Sustainability notes:

> Both the term and the concept "just transition" have met strong resistance among many workers, unions and the AFL-CIO. That resistance is deeply rooted in the experience of American workers and trade unionists. (…) "Workers who have had well-paying jobs have seen big changes and the working class feels it's gotten the short end of the stick. Holding onto fossil-fuel jobs is seen as the only way to maintain a decent life for them and their families. They've seen when their friends and family lose their jobs life is hard. Working people are afraid of change that involves job loss."[99]

In California, there is a tremendous opportunity to address just transition in a way that actually protects workers and communities, both because there is still time to plan ahead and because, compared to other states, the scale of the problem is small. So far, there is no evidence of job loss in any sector due to the impact of climate policy, probably thanks to a combination of California's lack of dependence on coal mining or in-state coal-fired power plants and the state's long history of environmental regulation that has cleaned up or discouraged dirty manufacturing. In addition, the cap-and-trade system was designed to avoid a shift in production and emissions from California to states with less-stringent climate regulations, a phenomenon known as leakage.[100] As a consequence, CARB has allocated free allowances to specific sectors—including oil and gas extraction and refining; mining; heavy-emitting manufacturing; and dairies—that would be at risk of leakage due to their high emissions and exposure to out-of-state competition.[101] This provision works to limit job loss in the short run, but as the emissions cap tightens—and as other states also limit emissions—decline in these sectors may become more likely.

As California's targets for GHG reductions accelerate over the next several decades, the risks of job loss due to declines in oil and gas extraction and refining and other high GHG-emitting industries and changes in the utility industry should not be ignored. . . . Meeting the legitimate needs of affected workers and communities should be part of the state's comprehensive plan for climate change mitigation and adaptation.

As California's targets for GHG reductions accelerate over the next several decades, the risks of job loss due to declines in oil and gas extraction and refining and other high GHG-emitting industries and changes in the utility industry should not be ignored. The cost of transitioning to clean energy should not be paid by workers who, through no fault of their own, depend for their livelihoods on facilities that society decides to phase out. Meeting the legitimate needs of those workers should be part of the state's comprehensive plan for climate change mitigation and adaptation. In the words of climate labor activists Jeremy Brecher and Brendan Smith, "It is a basic principle of fairness that the burden of policies that are necessary for society—like protecting public health and the environment—shouldn't be borne by a small minority who happen to be victimized by their side effects."[102]

Clearly, more research and information is needed in this regard. Planning for transition includes proposing strategies to avert layoffs (for example, by transferring employees to other jobs within a company), providing for the needs of workers who are displaced, and planning community economic rede-

velopment to limit the loss of local and state tax revenue and to rebuild local industries in areas heavily dependent on fossil fuel production.[103] Other strategies include addressing concerns that we have categorized as "environmental justice" issues but clearly could also be identified as "just transition" issues: environmental remediation to clean up sites associated with fossil fuel extraction and refining and initiatives to stem the impact of higher electricity bills.

On several occasions in the past, CPUC has taken steps to promote worker and community transition. For example, during the restructuring of the electric utility industry changes to the public utilities code included a transition charge for electrical generation to pay "employee-related transition costs incurred and projected for severance, out placement, retraining, early retirement, and related expenses for employees directly affected by restructuring."[104] Discussions on transition are also central to planning the closure of the Diablo Canyon nuclear plant.[105]

Advanced planning and notification can mitigate economic dislocation from the closure of plants, refineries, or other industrial facilities over the long term. Many states have required worker transition plans following utility restructuring and in advance of nuclear decommissioning.[106] For example, Minnesota mandates that nuclear generating stations create Worker Transition Plans that detail pathways for all workers covered by a collective bargaining agreement toward early retirement, retraining, reemployment in a similar/different career path within the utility, or assistance finding employment outside of the utility. A similar planning strategy in California for at-risk facilities—such as refineries, electrical generating stations, cogeneration facilities, cement plants, and others—could identify early needs around which a just transition strategy could be developed.

Analysis and reporting should require stakeholder engagement and include the following elements:

- Analysis of likelihood of closure, including a timeline; possible strategies to avoid closure such as pollution abatement; and a strategy for environmental remediation following closure.
- Workforce analysis, including estimated compensation, education, pension, and other benefit costs, and "skill-gap requirement and career path" options for existing workers to determine possible areas of employment within emerging energy fields.[107]
- Community cost-benefit analysis of major changes to facilities.

2.4 Public Accountability: Criteria, Progress, and Challenges

In the preceding sections, we have focused on what we might think of as outcome criteria: Are the results of a policy fair and equitable in some predetermined way? Here, we address the question: What processes do we need to advance equity in climate policy? Table 4 presents the criteria for public accountability in climate policy decision-making and program implementation. Public accountability refers to the obligation of public decision-makers and organizations to ensure that the outcomes of their programs and policies are effective—that they deliver what was promised to the impacted constituencies. These criteria reinforce progress on environmental justice and economic equity outcomes by enhancing the quality of participation by key constituencies in public decision-making, by facilitating more transparent monitoring of equity outcomes, and by fostering continuous learning about and improvement of the design and administration of climate policy.[108]

Table 4: Public Accountability

Principle 3. PUBLIC ACCOUNTABILITY

No.	Criteria
Goal:	Enhanced participation in public decision-making.
PA1	Fosters inclusive and effective participation of key constituencies at every stage of the decision-making process.
Goal:	Transparent monitoring of equity outcomes.
PA2	Translates desired equity outcomes into measurable benchmarks for continuous monitoring.
PA3	Generates reliable, consistent, publicly available data on equity outcomes.
Goal:	Continuous learning and improvement.
PA4	Allows for midcourse corrections and policy learning to advance equity goals.

2.4.1 Enhanced Participation in Public Decision-Making

Research shows that when affected stakeholder groups participate in public decision-making that impacts them, government becomes more accountable to the public good.[109] Criterion 3.1 proposes that climate policy foster meaningful participation of these constituencies at every stage of the decision-making process in order to improve equity outcomes. Doing so involves three interrelated steps. The first step recognizes which voices should be at the decision-making table by identifying affected constituencies and organizations that represent them. A second step to fulfilling criterion 3.1 requires government to build internal processes and strategies so that participation has real influence on decision-making. For example, inviting public comment on technical information communicated in a bureaucratic style

can stifle voices that have less capacity for using official jargon.[110] Government must proactively engage communities and provide technical and financial support on an ongoing basis to help communities build their own capacity for effective engagement.[111] Government staff—especially those agencies that have a history of not recognizing the expertise that communities bring to the table—should develop outreach strategies to engage representative groups early on and remove any technocratic and bureaucratic barriers to their participation. The interests of key constituencies can also be represented via direct participation in decision-making bodies, formally diversifying the membership of powerful state advisory committees. Finally, a third step entails extending participation to all stages of decision-making in legislative, regulatory, and enforcement initiatives, including on-the-ground data collection and analysis, problem identification, policy formulation, and implementation planning, evaluation, and oversight activities.

A number of California climate policies have helped to foster more effective participation from key equity constituencies. As mentioned in Section 1.2.1, "The Environmental Justice Movement," California's landmark Global Warming Solutions Act (AB 32) incorporated impacts on disadvantaged communities as an essential statutory consideration for every climate program implemented to reduce greenhouse gases. It also created the Environmental Justice Advisory Committee (EJAC) as one of two advisory committees tasked with advising the California Air and Resources Board (CARB) on AB 32 implementation. However, because there were no formal mechanisms in place requiring CARB to follow EJAC's advice, this committee's recommendations were largely ignored, while the other advisory committee—the Economic and Allocation Advisory Committee, consisting of experts focused on designing a cap-and-trade system for AB 32 implementation—had more influence.[112] EJ groups sued the state on procedural grounds, alleging that CARB had ignored important equity concerns in creating a cap-and-trade system that could result in emission increases in communities already burdened with dirty air.[113] Although they lost the suit, the conflict exposed the tensions that emerge when decisions about how to address the climate crisis appear to ignore community input.

Since then, a handful of climate policies have institutionalized the representation of EJ interests in state bodies. With the signing of AB 1288 into law in 2015, CARB now reserves two board appointments for people who work directly with low-income communities and communities of color. This law helps to ensure that the EJ movement's equity concerns are voiced at the highest levels of decision-making on climate and air quality issues.

The passing of SB 535 in 2012 widened the opportunities for grassroots organizations representing disadvantaged communities to collaborate with state agencies in decision-making about GGRF investments.[114] CARB included input from the SB 535 Coalition and many others in writing its "Funding Guidelines for Agencies that Administer California Climate Investments."[115] Under these guidelines, state agencies that administer GGRF investments benefiting disadvantaged communities must "implement outreach efforts that seek to engage and involve disadvantaged community members or their representatives," beginning with early stages of soliciting proposals. For example, the CSD regularly engages the SB 535 Coalition members for input on the implementation of low-income weatherization and solar installation programs. In addition, CARB has proposed to increase financial and technical resources to support community engagement. This support includes preparing application proposals on behalf of disadvantaged community groups and serving as a dedicated liaison between communities and agencies administering programs.[116] For example, in 2015 CEJA was part of the effort to secure $500,000 in technical assistance to help lower-income and disadvantaged communities access GGRF funding for affordable housing to ensure that disadvantaged communities are not left out of land-use planning and affordable housing funding in the future.

Labor's participation in public decision-making on climate policy differs from that of the EJ community in several ways. Labor has influence at the highest levels of state decision-making because unions are a critical electoral base for Democratic elected officials. In addition, many labor unions have a strong governmental affairs infrastructure to engage with the Legislature and the Governor's Office. The building trades unions have used this infrastructure to influence key climate policies, such as the Renewable Portfolio Standard and securing a PLA for high-speed rail. However, labor's influence has rarely filtered down to climate policy implementation. Despite having powerful lobbying resources, labor unions have mostly restricted their participation in climate policy and regulation to policy initiatives where "big wins" are likely (e.g., RPS, high-speed rail). Compared to representatives from environmental non-governmental organizations (ENGOs), environmental justice, or consumer advocates, labor unions have had much less formal or informal voice in the key regulatory arenas of CEC, CPUC, or CARB, the last of which now has two dedicated EJ appointments. As a result, labor often goes unrecognized as a legitimate constituency by agency staff who make the myriad of decisions that affect climate policy implementation. Together, the lack of outreach by agency staff and limited participation by labor unions has restricted labor's influence on the broad range of important climate equity issues concerning job quality and workforce development.

One exception is AB 3018, also known as the California Green Collar Jobs Act of 2008, which provides a formal arena for discussion of workforce issues. This law requires the California Workforce Investment Board (now called the California Workforce Development Board, CWDB) to establish a special committee

known as the Green Collar Jobs Council (GCJC) to undertake activities aimed at developing a strategic workforce initiative and to annually report to the Legislature on those activities. The GCJC includes representatives from labor, business, the training and education community, and state government. These representatives are tasked with collaborating to create recommendations for workforce development and job quality issues in climate policy implementation—many of which parallel the recommendations addressed in this report.[117] The GCJC produced a set of recommendations for workforce and jobs policies for the transition to a low-carbon economy, which this Climate Policy Equity Framework echoes.[118] Thus far, however, these GCJC recommendations have had little influence on climate-related jobs policy, in part because the Green Collar Jobs Council, siloed within the CWDB, has no authority with the state energy and climate agencies.

2.4.2 Transparent Monitoring of Equity Outcomes and Continuous Learning and Improvement

Advancing equity through greater public accountability in climate policy ultimately requires transparent monitoring of equity outcomes. This effort involves translating desired equity outcomes into measurable benchmarks and generating reliable, consistent, publicly available data on equity impacts. Just as climate policies set targets for GHG emission reductions and track progress towards those goals, climate policies can also include equity targets. By setting benchmarks for achieving equity goals, policymakers and key constituencies can monitor progress towards those goals to ensure that there is continuous improvement. This process also helps spotlight areas for midcourse corrections. Continuous learning and improvement of this kind contributes to more effective policy design in the future.

Effective benchmarking hinges on the ability to monitor progress, which in turn depends on reliable, consistent, publicly available data. Currently, reporting on the equity impacts of climate policy is inadequate—a point we highlight repeatedly in the preceding assessments of climate policy on environmental justice and economic equity. To generate reliable data on a regular basis, climate policies require a well-structured, comprehensive, and harmonized reporting framework and disclosure requirements for the state agencies, contractors, energy providers, and others implementing GHG reduction programs on the ground. Data on equity impacts and any corresponding analytical tools must be accessible to both public officials and affected constituencies in order to foster meaningful participation on equity goal-setting and benchmarking as well as learning to correct for undesirable outcomes.

Although reporting on equity impacts related to climate policy has been scattered and uncoordinated, there are a number of notable initiatives that can inform a more comprehensive approach to tracking equity outcomes across all of California's GHG reduction programs. Proposition 39, the Clean Energy Jobs Creation Fund, provides one model for tracking economic equity in a clean energy program because the implementing legislation requires the California Labor and Workforce Development Agency to report on job creation. Since Prop. 39 projects are public works, which already require that contractors and subcontractors register with the state Department of Industrial Relations and maintain certified payroll records for all workers covered by prevailing wage laws, detailed data is available on hours worked,

wages and benefits, number of apprentices, and zip codes of the blue-collar construction workforce. This information will allow much more detailed analysis of the quantity, quality, and geographic profile of the workforce than previously available.[119]

On the environmental justice side, in addition to the important work already done to create the CalEnviroScreen to identify disadvantaged communities, CARB is working to develop a more comprehensive approach to tracking both the positive and negative impacts of the cap-and-trade program. As discussed above, the agency's proposed Adaptive Management Plan lays out a process for continuous evaluation of facility-level GHGs and neighborhood-level air pollution impacts. Although we suggest ways to strengthen this approach, there are number of model features in CARB's Adaptive Management Plan, including the public availability of its GHG tracking tool and its framework for continuous learning and policy correction. In addition, CARB is developing a reporting framework for agencies administering GGRF appropriations to track the co-benefits of cap-and-trade investments. If such a framework pushes agencies to collect data from contractors on job creation, job quality, and job access, it may lay the groundwork to track equity outcomes across GGRF funding programs.

Without specific intervention, the same market forces that produce wage disparities and inequality in the economy as a whole can be expected to impact the emergent low-carbon industry sectors.... Reporting on equity impacts related to climate policy has been scattered and uncoordinated, but there are a number of notable initiatives that can inform a more comprehensive approach to tracking equity outcomes across all of California's GHG reduction programs.

A number of other data efforts have potential to contribute to tracking equity outcomes. The state of California produced an online map of investments from a variety of climate policies in agriculture, renewable energy and energy efficiency, clean transportation, and waste and recycling.[120] The Bay Area organization Transform also created the "Climate Benefits for California" map that shows the location of GHG reduction projects funded by the GGRF.[121] With additional data on co-benefits, these tools could track the environmental justice and economic equity outcomes associated with these investments.

Table 5 expands the climate policy equity framework by suggesting key performance indicators for the equity criteria presented.[122]

Table 5. Climate Policy Equity Framework with Goals, Criteria and Performance Indicators

Principle 1. ENVIRONMENTAL JUSTICE

No.	Criteria	Indicators of Progress on Equity Goals
Goal:	Reduced environmental and public health risks to disadvantaged communities.	
EJ1	Decreases pollution regionally and locally in toxic hotspots.	o Have facility-level GHG emissions decreased? o Have facility-level criteria and toxic air emissions decreased? o What is the geographic distribution of abatement vs. trading? How do disadvantaged communities and affluent communities compare?
EJ2	Improves public health outcomes associated with pollution exposure and climate vulnerability.	o Have health outcomes associated with ambient air pollution improved at the neighborhood level in fenceline communities?
Goal:	Expanded access to benefits in disadvantaged communities.	
EJ3	Expands access to goods and services arising from clean, low-carbon development (e.g., renewable energy, low-carbon mobility).	o Are low-carbon goods and services concentrated in higher-income households? o Can the public and low-income communities access the benefits of programs funded with public/ratepayer resources without assets and access to credit (e.g., homeownership)?
Goal:	Protection from adverse economic consequences for disadvantaged communities.	
EJ4	Avoids raising the cost of electricity, transportation fuel, and water for disadvantaged communities.	o Has energy affordability changed? Has the percentage of income spent on utilities changed for low-income households? o Are mechanisms in place to offset the burden of price increases for low-income households (e.g., direct rebates, discounts on utility bills)?
EJ1	Increases economic and social resilience to gentrification-induced displacement created by low-carbon urban development.	o Have disadvantaged communities experienced gentrification due to sustainable urban development initiatives? o Do sustainable community strategies include anti-displacement measures?

Principle 2. ECONOMIC EQUITY

No.	Criteria	Indicators of Progress on Equity Goals
Goal:	High-quality, career-track jobs in clean economic growth sectors.	
EE1	Generates jobs with family-supporting wages, benefits, career paths, and safe and healthy working conditions.	o Are new jobs in the clean economy good jobs with family-supporting wages, benefits, safe working conditions, and opportunities for acquiring skills and moving up the wage ladder?
EE2	Supports prevailing wage and skilled workforce standards in the construction industry.	o Are labor standards in place requiring prevailing wage and skilled certifications (e.g., PLAs, CBAs, responsible contractor requirements, or similar contract provisions)?
EE3	Increases access to career-track jobs for workers from disadvantaged communities.	o Has there been an increase in the number of disadvantaged workers who have been hired into career-track jobs or placed in state-certified apprenticeship programs? o Are there mechanisms in place to broaden opportunities for disadvantaged workers to access career-track jobs?
Goal:	Just transitions for workers and communities in sectors at risk of decline due to climate policy.	
EE4	Provides income supports, retraining, and job placement into comparable jobs for displaced workers or bridges to retirement for older workers.	o Have displaced workers been able to maintain their standard of living? o Are there mechanisms in place to help adversely impacted incumbent workers transition to equivalent work or to provide a bridge to retirement?
EE5	Supports economic development for communities affected by plant closures and sector shrinking.	o Have communities recovered from displacements caused by climate policy? o Is assistance in place to help affected communities address the multiple impacts of plant closures?

Principle 3. PUBLIC ACCOUNTABILITY

No.	Criteria	Indicators of Progress on Equity Goals
Goal:	Enhanced participation in public decision-making.	
PA1	Fosters inclusive and effective participation of key constituencies at every stage of the decision-making process.	o Are rules, structures, and resources for dialogue and decision-making in place that create meaningful participation, exchange, and influence over decision outcomes? o Does participation in decision-making extend to all stages of legislative, regulatory, and enforcement initiatives?
Goal:	Transparent monitoring of equity outcomes.	
PA2	Translates desired equity outcomes into measurable benchmarks for continuous monitoring.	o Are benchmarks identified to measure progress on outcomes of importance to communities, policymakers, and equity stakeholders?
PA3	Generates reliable, consistent, publicly available data on equity outcomes.	o Is a reporting framework in place that generates publicly available data on key metrics and benchmarks in a timely manner?
Goal:	Continuous learning and improvement.	
PA4	Allows for midcourse corrections and policy learning to advance equity goals.	o Is there an adaptive management plan in place to respond when midcourse corrections are needed?

3. Finding Common Ground for Advancing Equity in Climate Policy

In this section, we demonstrate how equity can be advanced in GHG reduction strategies in two critical sectors—energy efficiency (EE) and renewable energy (RE)—using the Climate Policy Equity Framework. Both energy efficiency and solar generation are clearly relevant to the implementation of the Clean Energy and Pollution Reduction Act of 2015 (SB 350), which sets stronger statewide goals for 2030: (1) to increase the procurement of electricity from renewable sources from 33 percent to 50 percent; and (2) to double energy efficiency savings of retail customers for electricity and natural gas through energy efficiency and conservation. These new targets will help California achieve its new SB 32 goal of slashing GHG emissions 40 percent by 2030, while spurring new investment for expanding solar energy generation and energy efficiency throughout the state.

In Table 6, we highlight four relevant criteria listed under two of the main equity goals. These criteria provide clear guideposts that can be translated into program design, customized for each sector and context.

Table 6. Translating Equity Goals into Strategies in the Energy Efficiency and Renewable Energy Sectors

Relevant Criteria from the Climate Policy Equity Framework		Customized Strategies
Environmental Justice Goal: Expanded access to benefits in disadvantaged communities.		
1.3	Expands access to goods and services arising from clean, low-carbon development (e.g., renewable energy, low-carbon mobility).	o Target subsidies for EE and RE specifically to households in disadvantaged communities. o Promote clean energy deployment models that are accessible to less-affluent households.
Economic Equity Goal: High-quality, career-track jobs in clean economic growth sectors.		
2.1	Generates jobs with family-supporting wages, benefits, career paths, and safe and healthy working conditions.	o Incorporate labor standards, including prevailing wages, apprenticeship standards, and other energy-specific skill certifications, into clean energy programs whether publicly or ratepayer funded. o Develop project labor agreements (PLAs) or community workforce agreements (CWAs) with targeted hire provisions.
2.2	Supports prevailing wage and skilled workforce standards in the construction industry.	
2.3	Increases access to career-track jobs for workers from disadvantaged communities.	

To address the goal of expanded access to benefits, policies must ensure that the benefits of increased investments in energy efficiency and renewables accrue to households in low-income communities as much as (or more than) they assist Californians with higher incomes. Programs should ensure that public and/or ratepayer investments are spread to low-income communities via specific carve-outs that provide greater subsidies for low-income households, insulate low-income households from rising utility bill costs, or offer other strategies to overcome the barriers that low-income households and communities face in accessing clean energy programs.

To address the goal of high-quality, career-track jobs in clean economic growth sectors, policy and program design can ensure that low-carbon investments support "high-road" employers and good jobs. One key strategy—which has a track record of improving job quality and job access—is the use of community workforce agreements (CWAs) that couple targeted hire agreements with labor standards, including prevailing wages, apprenticeship standards, and other energy-specific skill certifications. The state's certified apprenticeship programs—known as the "college for construction workers"—offer the best skilled construction trades training that leads to industry-recognized credentials. Requiring contractors to participate in state-certified apprenticeship programs can guarantee that the workforce receives broad occupational training and wage increases as skills are acquired and help ensure the deployment of a highly skilled workforce.[123]

To make sure that the growth of career-track construction jobs in EE and RE reach those who face barriers to employment in disadvantaged communities, these job quality standards are often coupled with targeted hire agreements, which have a track record of increasing the entry of disadvantaged

IBEW Local 569

workers into apprenticeship. Pre-apprenticeship programs, which provide workers from disadvantaged communities with the skills they need to enter the apprenticeship pipeline, can support this strategy and ensure that contractors can easily access a qualified workforce that meets the targeted hire requirement. Pre-apprenticeship programs are most effective when they are formally linked by partnerships with at least one certified apprentice program to guarantee tight coordination on timing, needs, and curriculum.[124] A model approach is the California Workforce Development Board's Prop. 39 Pre-Apprenticeship Support, Training, and Placement Grant program, which requires the involvement of local building trades councils and the use of the multi-craft core training curriculum (MC3) developed by the national building trades department of the AFL-CIO.[125]

Though complex to those unfamiliar with it, the construction labor market strategy just described has a proven track record in many public works projects. Replicating it in the energy efficiency and renewables arena can occur through several avenues: instituting labor standards in market segments where they haven't been required; adding targeted hire and pre-apprenticeship infrastructure where labor standards already exist; and expanding those market segments that already have incorporated most or all of this strategy. The following two case studies of energy efficiency and renewables touch on all of these possibilities. Although examples of equity "win-wins" in the energy efficiency sector are more readily available, potential "win-wins" for equity may be found in solar generation as well, particularly in new models of community-scale solar.

3.1 Equity Strategies in Energy Efficiency: Pre-Apprenticeship Job Training and Weatherization for Low-Income Communities

Energy efficiency is a key element of the state's GHG reduction strategies and is first in the loading order of California's preferred energy resources. The state's energy efficiency incentive programs and its building codes and appliance standards have reduced demand for energy, helping to cut millions of tons of carbon dioxide emissions and other co-pollutants through avoided new power plant construction.[126] Between 1972 and 2007, California households saved more than $56 billion dollars on energy, a savings that has rendered unnecessary the capacity of 24 traditional coal-fired power plants.[127] And energy efficiency has been ahead of other clean energy efforts in carving out funding specifically for retrofits for low-income households through the low-income weatherization program (ESAP) of the investor-owned utilities (IOUs) and the federally funded weatherization program administered by the California Community Services Department (CSD).

In 2015, California re-upped its commitment to energy efficiency by passing SB 350, which sets a goal of doubling annual energy savings by 2030. Unlike the new 50-percent renewables goal embedded in the Renewable Portfolio Standard (RPS), SB 350's energy efficiency target is not accompanied by a specific mechanism for its achievement. IOUs have traditionally provided the biggest funding stream to incentivize private investments in energy efficiency retrofits and subsidize low-income weatherization. Recently, this funding has been supplemented by Prop. 39 for K–12 school retrofits and the Greenhouse Gas

Reduction Fund (GGRF), which has increased funding for CSD's weatherization program and for retrofits for the public university system. Other recent legislation and regulatory action may spur greater investments in energy efficiency by allowing IOUs to provide incentives for retrofits that meet current code, changing previous requirements for above-code-only incentives, and providing a variety of new data that can inform investment opportunities. It is not yet clear, however, if these current programs and recent policy changes will be sufficient to double energy savings by 2030.

A best-practice model is the LADWP low-income weatherization program, which was designed to expand the utility's GHG reduction efforts by funding energy efficiency retrofits to low-income households while generating paid training and employment for entry-level utility workers.

3.1.1 A Model Energy Efficiency Program: LADWP's Utility Pre-Craft Training Program

A best-practice model is the LADWP low-income weatherization program, which was designed to expand the utility's GHG reduction efforts by funding energy efficiency retrofits to low-income households while generating paid training and employment for entry-level utility workers.[128] The LADWP program was implemented via the Utility Pre-Craft Training (UPCT) program, which developed through a unique collaboration between the largest municipal utility in the country, the Los Angeles Department of Water and Power (LADWP), and the International Brotherhood of Electrical Workers (IBEW) Local 18, which represents most of the workers at the utility. The creation of the training program was supported by RePower LA, a Los Angeles-based coalition anchored by IBEW Local 18, the Los Angeles Alliance for a New Economy (LAANE), and Strategic Concepts in Organizing and Policy Education (SCOPE). The RePower LA coalition demonstrates how labor, environmental justice, workforce, and community-based environmental organizations in Los Angeles can successfully envision and bring to fruition a comprehensive strategy to increase agency commitment to energy efficiency investments while meeting key equity goals.

As an earn-while-you-learn pre-apprenticeship training program, UPCT works as a pipeline into a family-supporting career. The program, with assistance from RePower LA and workforce partners, recruits entry-level workers from disadvantaged communities who may lack the background needed to score high enough on civil-service examinations to be considered for employment. Once accepted into the program, pre-apprenticeship trainees become union members, even though they are "exempt" from civil service and not yet permanent employees. As union members, UPCT trainees work as full-time, paid weatherization installers in LADWP's low-income-targeted residential weatherization program, earning $16.00 per hour with full health benefits while receiving classroom and on-the-job training as well as

online instruction to prep for civil service exams. They also gain experience working in other parts of the utility, including in the warehouse and the water system.

LADWP and IBEW Local 18's Utility Pre-Craft Trainees

Once they are hired into an apprentice-level civil service position, graduates of the UPCT program are on track for many occupations, including line worker, electrical mechanic, and steam plant operator.[129] Unlike other "green skills" training programs in California that are geared towards volunteer and/or short-term jobs with limited skill development,[130] UPCT channels people into long-term careers with family-supporting wages and benefits, including health care, pension, and career training.

The UPCT program is an integral part of LADWP's energy-efficiency retrofits for low-income homeowners. By providing a trained workforce, the UPCT program ensures that installation, operation, and maintenance are done properly so that retrofits are actually effective at GHG reduction. The RePower LA campaign and the success of the program had a strong influence in increasing LADWP's commitment to energy efficiency. The utility has since begun to invest in energy efficiency as a procurement strategy as part of its pledge to produce 100 percent of its power without coal by 2025.

3.1.2 Coalition Formation and Building a Common Agenda

The RePower LA coalition formed in 2011 as a project of LAANE, SCOPE, and IBEW Local 18 just as LADWP staff were seeking approval for a rate hike from the Board of Commissioners and City Hall. At the time, LADWP faced pressure from the City of Los Angeles to decarbonize and sought pathways to meet its RPS goal to acquire 20 percent of its power from renewable sources by the end of 2010 and 35 percent by 2020. In a series of town-hall-style meetings, RePower LA brought together community, labor, and environmental stakeholders to argue for increased energy efficiency investment and the expansion of job opportunities through the UPCT program. As the campaign grew, the original organizations were joined by

Communities for a Better Environment (CBE), the California Environmental Justice Alliance (CEJA), the Sierra Club, and the Natural Resources Defense Council (NRDC), as well as small businesses, neighborhood council and block club leaders, and non-profit workforce development groups.

The coalition proposed that LADWP commit greater investment to energy efficiency programs, highlighting the value of lowering bills for lower-income customers and providing pathways into utility work for community members. At each town hall, the coalition drew speakers from the community, IBEW Local 18, and the environmental movement. In 2012, the LADWP Board adopted a proposal to double their EE budget to meet a stretch goal of 15-percent savings, create a training program to prepare community members for utility jobs, and support struggling electricity customers by weatherizing their homes. (In 2014, the Board of Commissioners approved a hard target of 15 percent). The Board also adopted a set of guiding principles for energy efficiency to ensure that the larger budget would serve all customers and be leveraged to create quality job opportunities through the UPCT program, which had launched in 2011 with federal stimulus funding. IBEW Local 18's Brian D'Arcy, the chief architect of the UPCT program, worked with the Joint Training Institute (a labor management partnership at LADWP), the Los Angeles Trade-Technical College (LATTC), and UCLA's Labor Occupational Safety and Health program to design a training program accessible to LA's disadvantaged communities. For the IBEW local, which faces an aging workforce (40 percent of LADWP union employees were at or near retirement age at the time of the UPCT program's launch), the UPCT program is building a new generation of union workers that better reflects the Los Angeles workforce demographics, helping IBEW 18 to gain allies and adherents from the city's low-income communities. About 65 percent of trainees in the initial recruiting came from communities with rates of unemployment at least 50 percent above average in Los Angeles County.[131]

The UPCTs have also participated in the direct installation of energy efficiency measures for LADWP's largest customer, the Los Angeles Unified School District. Eventually, they will work on clean energy projects, too. The expanded energy efficiency portfolio includes a sizable program for small businesses, which for the most part employ workers from the construction electricians' IBEW Local 11, and also has created training opportunities for five non-profits that hire youth and disadvantaged workers to do outreach in advance of the installations.

As pressure for an electricity rate hike grows at the utility, the RePower LA coalition is advocating for LADWP to expand investment in customer outreach to increase awareness of opportunities to stabilize utility bills through energy efficiency and, in the future, community solar. The coalition is also working on building up an infrastructure to support community members on the UPCT program waitlist, which is as long as two years. Between 2011 and 2018, the program estimates hiring more than 300 new entry-level workers through the UPCT program (not including other "high-road" jobs created through the expanded energy efficiency and direct install programs).[132] The RePower LA coalition has helped to connect disadvantaged communities to these job opportunities. In addition, increased energy efficiency in low-income residential markets offers an important mechanism for community resilience by helping lower-income communities withstand rate increases.

3.1.3 Replicating LADWP's UPCT Model to Advance Equity and Energy Efficiency

The basic features of LADWP's UPCT model can be applied in other low-income residential weatherization programs currently administered by POUs, IOUs, and state agencies. Critical features can also be applied in non-low-income energy efficiency programs. These core features include: (1) jobs with labor standards, including both wage and apprenticeship or other skill standards, to ensure good jobs and high-quality work; (2) investing in pre-apprenticeship training and recruiting from low-income communities and communities of color to ensure a pool of qualified targeted workers; and (3) ensuring that benefits of the investment don't go just to higher-income sectors, but to low-income groups, as well.

LADWP and IBEW Local 18's Utility Pre-Craft Trainee

Significant equity gains can come from incorporating these features into existing public and private energy efficiency programs—particularly in IOU programs—as well as future programs that emerge to meet the goals of SB 350. The state's three IOUs have the largest funding pool for energy efficiency projects. In 2014, IOUs directed more than $1.3 billion in incentives and rebates for energy efficiency in residential, commercial, and public buildings (including low-income programs).[133] Given this level of ratepayer-funded investment, IOUs are critical players in advancing equity in the energy efficiency sector. State agencies also administer important energy efficiency programs. Programs funded by the state's Greenhouse Gas Reduction Fund (GGRF) are expected to increase. In 2014–2015, GGRF appropriations for energy efficiency included $75 million to the CSD for single- and multifamily low-income housing; $20 million to the California Energy Commission (CEC) for building retrofits for energy efficiency; and $10 million to the California Department of Food and Agriculture.[134] CEC administers the California Clean Energy Jobs Act (Prop. 39), a five-year program with an annual budget allocation of up to $550 million annually for energy efficiency and clean energy retrofits in K–12 public schools and community colleges, started in 2013–2014.

A prime opportunity for promoting deep retrofits, good jobs, public benefits, and more opportunities for workers from disadvantaged communities is investment in public-sector MUSH (municipality, university, school, and hospital) markets. Projects in MUSH markets are usually already subject to prevailing wage and apprenticeship requirements and include larger projects and more complex work requiring higher skills (and higher wages). Public ownership also offers opportunities for deeper retrofits that require longer payback periods. While Proposition 39 has provided significant funding for a segment of the

MUSH market, there remains a sizable cost-effective investment opportunity that can lower GHG emissions, provide benefits in disadvantaged communities, generate good jobs with benefits, and broaden opportunities for entry-level workers from disadvantaged communities.

While we have focused on how promoting labor standards can enhance equity, this strategy can also have a positive impact on energy savings. Retrofitting single- and multifamily residential, public, commercial, and industrial buildings involves multifaceted skill sets and evolving technologies. A substantial body of research documents work-quality problems in energy efficiency projects involving HVAC, advanced lighting controls, weatherization, and new construction.[135] Significant energy savings are lost due to incorrect and poor-quality installations and suboptimal management and operations of buildings and their systems.[136] Lack of standards to ensure that contractors and workers have the appropriate skill sets can create a number of work-quality problems that can undermine potential energy savings.[137] Ensuring deployment of a well-prepared workforce is critical for IOUs to meet their energy-saving goals.

3.2 Solar Energy Deployment to Reduce GHG Emissions, Close the Climate Gap, and Grow Family-Supporting, Career-Track Jobs

California currently leads the nation in solar energy generation, demonstrating an economically feasible transition from fossil fuel to renewables in electricity production. However, the benefits of solar development in California have been distributed unevenly. This case study outlines the trade-offs and tensions between labor unions, environmental justice groups, and other economic interests supporting solar development in California. Using relevant criteria from the Climate Policy Equity Framework, we explore how the current trajectory of solar development can better achieve equity goals without compromising the growth of solar power at a feasible cost.

Although both groups generally share the principles in the Climate Policy Equity Framework, labor and environmental justice in California have had different priorities in the solar sector. Partly as a result, they have found themselves on opposite sides in a number of critical legislative and regulatory deliberations with regard to the solar industry. Most of the tensions between EJ and labor relate to policies that tip the balance towards either utility-scale or distributed solar generation (often called rooftop solar). For the labor movement, utility-scale solar has provided good, mostly unionized, jobs with family-supporting wages, broad occupational training through apprenticeship, and a path to a career in the skilled trades. By comparison, most solar rooftop installers are non-union, are paid low wages, receive few benefits, and lack clear pathways for training and career advancement, as detailed in Section 2.3, “Economic Equity: Criteria, Progress, and Challenges.”

For environmental justice advocates, the distributed rooftop solar industry represents an opportunity to provide direct access to—and see the benefits of—clean energy in disadvantaged communities, including jobs and investments in disadvantaged urban areas. Because evidence shows that ratepayer subsidies

and incentives for rooftop installation have thus far concentrated in higher-income groups in California, EJ groups have thought it important to support policies that promise to bring rooftop solar panels to disadvantaged communities, along with the benefits of utility bill savings and clean energy jobs. Many EJ groups recognize the low-wage trend in the rooftop solar industry but question the extent to which utility-scale solar provides jobs for disadvantaged workers, especially for those residing in urban areas.

Labor and environmental justice groups in California have had different priorities in the solar sector. Partly as a result, they have found themselves on opposite sides in a number of critical legislative and regulatory deliberations with regard to the solar industry.... But there are opportunities to move beyond this divide and develop policies that address equity interests comprehensively.

Although labor and EJ movements will continue to advocate for their respective priorities in policy debates about solar deployment, there are opportunities to move beyond this divide and develop policies that address equity interests comprehensively. New opportunities are likely to arise because the utility and clean energy industries are rapidly evolving, and new business models blur the traditional lines between utility-scale and distributed generation.[138] The equity framework may be useful in both asking and answering critical questions about how to achieve shared equity goals across current and future models of solar deployment, particularly to both generate more solar generation in low-income areas *and* secure higher-quality employment that reaches residents of those areas.

3.2.1 Comparing Models of Solar Development in California

In California, the greatest proportion (<80%) of solar energy comes from large utility-scale solar projects sited on sizeable swaths of land in rural areas in the San Joaquin and Imperial Valleys and on the Central Coast.[139] These projects sell wholesale electricity to utility buyers (mostly >20 MW, with approximately 11,234 MW installed between 2002 and 2015).[140] Rooftop-scale solar projects constitute a smaller share (<20%) of solar energy production in California (mostly <1 MW, which has contributed 2,400 MW since 2005).[141] These solar energy systems are mostly built on residential and commercial rooftops to generate electricity for on-site consumption, with any excess flowing back into the grid. A third segment of mid-sized solar systems remains a small share of the total but may grow in

the future (between 1 MW to 20 MW producing approximately 100 MW to date). These installations are often sited in urban areas and, unlike small residential rooftop solar systems, are not necessarily on the customers' property.

A variety of state and federal policies have driven the expansion of each model of solar deployment. The California Renewable Portfolio Standard (RPS) was the first major driver of utility-scale solar expansion, beginning in 2002, followed by the 30-percent federal tax credit for both utility and distributed solar.[142] The growth trajectory for rooftop solar has depended on this federal tax credit and the California Solar Initiative, a $2.2 billion rebate program for rooftop solar funded by California ratepayers through utility rebate programs. Net energy metering (NEM) policies also provide an indirect subsidy for rooftop solar (which is amplified for larger energy users due to the tiered retail rate structure). Under NEM, utilities must give customers a credit on their utility bill at the full retail rate for excess electricity sent back to the grid from their rooftop systems. This credit reduces the customer's bill by the amount of excess electricity charged at the retail rate, which is significantly higher than the wholesale rate paid to larger-scale solar producers in a Power Purchase Agreement (PPA). Since more than 90 percent of customer-sited solar projects in California take advantage of net energy metering,[143] and the installation of these projects continues to be dominated by the heaviest electricity-consuming households, the steeply tiered rate structure for residential users translates to a higher return for larger and generally more-affluent customers. UC Berkeley researchers estimate this financial incentive to be as important a driver of rooftop solar growth as the 30-percent federal tax credit.[144]

State policymakers have consistently supported a "both/and" strategy for utility-scale and rooftop solar, rather than choosing one over the other. As a result, policy debates circle around a variety of arguments that favor one or the other model, while recognizing that both have a role in our evolving energy landscape. It turns out, however, that the two major market segments for solar energy have different advantages in terms of generation costs, GHG emissions reductions, and ecological impact, as well as specific equity considerations such as job quality and access, energy affordability, and clean energy benefits in disadvantaged communities.

In terms of generation costs, a number of reports show that utility-scale solar is, at most, one-half the cost of consumer-owned rooftop solar per kilowatt-hour and, in some cases, as low as a quarter of the cost of rooftop solar.[145] The economies of scale achieved with utility solar include optimized panel placement, sun-tracking systems, and other production efficiencies that lower generation costs. Operational efficiencies help to keep the cost of solar energy low on ratepayers' utility bills, including those of low-income ratepayers.[146] Technologies are changing and are likely to bring down the costs of both utility-scale and rooftop solar, though some technological advances, like low-cost small-scale storage, may have a great cost impact on distributed solar.

The operational efficiencies of utility-scale solar can also result in greater GHG emissions avoidance than the equivalent amount of rooftop solar.[147] However, rooftop systems offer some efficiency advantages that contribute to GHG emissions reductions: generating electricity on-site avoids line losses that typically dissipate 7 to 8 percent of energy distributed over the electricity grid during transmission.[148]

From an ecological and land-use perspective, the use of existing buildings rather than large tracts of desert or other environmentally sensitive land makes rooftop solar attractive. Depending on their location, utility-scale solar projects can raise concerns about land degradation and habitat loss. The Desert Renewable Energy and Conservation Plan (DRECP) will restrict utility-scale developers' access to public lands that have a high conservation value, reducing by two-thirds the amount of acreage eligible for solar development and helping to focus solar development on already disturbed land.[149]

3.2.2 Opportunities and Challenges to Address Equity in Solar Expansion in California

In addition to the cost and environmental issues just described, EJ and labor groups have brought equity to the fore of policy discussions about solar deployment. In this regard, labor and EJ have not yet formulated a common policy agenda that supports both continued solar development and addresses multiple equity goals. Each group has prioritized different segments of the solar industry: labor has an established position in utility-scale renewables, while environmental justice groups have focused on policies and public investments that favor distributed generation. This juxtaposition has created some tensions between advocates who share a common concern about equity in California's climate policies.

Labor advocates for good jobs but has only found them in utility-scale solar deployment, where project labor agreements (PLAs) governing most utility-scale solar projects in California set union wage and skilled labor standards. As discussed in detail in Section 2.3, "Economic Equity: Criteria, Progress, and Challenges," job quality in California's rooftop solar industry tends to be considerably lower.

As far as job access, there are a number of disparate reports indicating that both models of solar deployment generate new jobs for members of disadvantaged communities. Unlike large solar farms, rooftop solar can be sited in urban areas where job needs are critical. A number of urban equity and workforce groups have mobilized to develop specific interventions to ensure the hiring of workers with significant and specific barriers to employment on urban rooftop solar. For example, in Los Angeles, GRID Alternatives (the administrator for the Single-Family Affordable Solar Homes Program launched in 2009 as part of the California Solar Initiative) maintains formal partnerships with Homeboy Industries and the East LA Skills Center, two community-based workforce development organizations that provide training to formerly incarcerated ex-gang members as a first step towards helping them accessing paid entry-level employment.

Of course, there are local-hire aspects to utility-scale projects, and because they use apprenticeship, these systems offer a more structured pathway into a middle-class career in a skilled trade than rooftop solar, as noted in Section 2.3. Solar farms have mostly been built in the San Joaquin and Imperial Valleys, both regions with disadvantaged communities from the top 15-, 20-, and 25-percent highest-scoring census tracts identified by the CalEnviroScreen. The PLAs governing four utility-scale projects in Imperial County contain local hire provisions. IBEW Local 569, the electricians union that represents about half of the construction workers employed on these projects (alongside workers represented by other unions

in the skilled trades), reported in 2013 that 1,000 journeymen, apprentices, and pre-apprentices (called electrical trainees) from Imperial County had been hired to construct these plants.[150] The Fresno Building and Construction Trades Council recently reported that 1,000 pre-apprentices have been trained, with many working on the construction of new solar farms. These reports are encouraging, but "local" doesn't necessarily mean "disadvantaged," and there is insufficient data to determine the ethnicity or other characteristics of workers who have been trained and hired. In contrast, the rooftop-solar job-training programs usually document participation by specific groups with significant barriers, such as the formerly incarcerated, ex-gang members, or at-risk youth.

The disparity in job quality and career trajectories between utility-scale and rooftop solar is important, however, because employment prospects for workers completing short-term, volunteer-based, or low-wage installation work are uncertain. The trades perceive the workforce development approach taken by groups like GRID Alternatives as undermining their attempt to maintain family-supporting labor standards in the construction market and using public resources to do so. And the data shows there is reason for concern. For example, GRID reports that out of 1,007 volunteers in the Los Angeles Area, there have been 213 solar industry hires since 2012.[151] This job-placement rate is low compared to many pre-apprenticeship programs, including those funded by Proposition 39, where a number of the programs have placed more than 70 percent of trainees.[152]

IBEW Local 569

Many EJ and economic equity organizations are now looking for ways to raise the wage floor in rooftop solar work and transform on-the-job training programs so that they lead participants into pre-apprenticeship or apprenticeship programs. For these groups, Community Workforce Agreements (CWAs) are an attractive strategy because they offer one of the few success stories for expanding career-track job opportunities for workers with challenging barriers. But tensions persist because the need for entry-level, career-track jobs exceeds their availability: the construction sector is a small part of total employment, the union construction sector even smaller, and unions calibrate apprenticeship openings to the number of available jobs. The

power of a CWA is that it increases the number of union construction jobs, which increases the number of new apprentices that the union can take in from the pool of targeted workers. Still, this model remains an incomplete solution to an economy-wide problem for community-based organizations trying to serve workers in need of good jobs.

This complex landscape has put EJ and labor groups on opposite sides of a number of policy debates on renewable energy. Labor has often opposed policies favoring rooftop solar expansion because that part of the market is not generally subject to regulatory mechanisms and business practices needed to encourage better wages. For this reason, the building trades unions supported SB 350, while successfully advocating (against the rooftop solar industry) to maintain the existing RPS structure. Under SB 350, distributed rooftop solar installations contribute to RPS compliance by reducing the total amount of retail sales on which the new 50-percent renewables target is based, but only a small percentage of rooftop solar can be additionally counted as part of the total renewables credited in the new RPS target.[153]

EJ groups have sought—and won—the support of the rooftop solar industry lobby in advocating for expanded access to rooftop solar installation and solar jobs in disadvantaged communities. Recent EJ advocacy has focused on increasing public or ratepayer investments for rooftop solar in disadvantaged communities. For example, in 2015, CEJA spearheaded AB 693, which created the Multifamily Affordable Housing Solar Roofs Program to expand ratepayer investments for rooftop solar in the state's large stock of multifamily affordable housing buildings. For rooftop solar industries, these policy victories represent access to new markets. Yet without labor standards on rooftop installation projects (AB 693 does not include labor standards), expanding access to sustainable high-quality careers in the rooftop solar industry for disadvantaged communities remains a challenging goal.

Tensions have played out dramatically in the net energy metering (NEM) debate, in which IOUs and the coalition of utility unions argued that CPUC should remove NEM as a subsidy that unfairly compensates ratepayers with solar installations while shifting the costs for grid upkeep to non-solar ratepayers. On the other side, rooftop solar companies as well as prominent environmental organizations and some environmental justice advocates lobbied CPUC to preserve NEM as a vital economic incentive for expanding rooftop solar, claiming that the loss of NEM would stifle the growth of an important source of GHG emissions reductions in California.[154]

Demystifying the positions that labor and EJ advocates have taken in these policy debates can expand future opportunities to build common-ground solutions to climate equity concerns. Labor views support for rooftop solar companies as part of a growing hostility toward their efforts to protect middle-class careers amid an economy-wide expansion of low-wage, precarious jobs lacking benefits and safe workplace conditions. EJ groups (and grassroots advocacy organizations) want local renewable jobs to be good union jobs but sometimes see opposition to rooftop solar development as working against their larger goal of mitigating climate change without leaving disadvantaged communities on the sidelines of low-carbon goods, services, and jobs. Greater understanding of why each group has supported a particular solar model can help overcome negative perceptions of the other and allow creative thinking on how to simultaneously address good jobs, localized benefits, and climate mitigation.

This important and vibrant debate also is playing out in an industry that is shifting due to business, regulatory, and technological innovations. New possibilities are emerging for decentralized transmission and "mini-grids" that bring new technologies together behind the meter, including cheaper photovoltaics, energy storage devices, and sophisticated low-energy appliances and software.[155] Utilities' business models are shifting to accommodate the growth of consumers who generate and store their own energy and the likelihood of a future where bidirectional power flows across a modernized networked grid is the norm. Some utilities are making forays into becoming distributed energy and storage providers themselves; others are focused on becoming a "neutral platform provider,"[156] offering customers a range of distributed solar and storage services, including energy efficiency and micro-grid demand response systems. New business relationships that span both models are developing as utilities consider owning some distributed generation, solar companies enter into procurement relationships with utilities, and independent power producers who used to sell only to the grid invest in distributed generation. New regulations in California will likely support these trends, given that CPUC is considering encouraging utility investments in distributed resources.[157] All this means that the boundaries—and tensions—between utility-scale and rooftop solar are likely to blur, or even disappear, over time.

This shifting terrain is even showing up in the contentious NEM debate. CPUC's 2016 decision continued NEM but has made a commitment to devise new rules to reflect costs incurred by increased rooftop solar feeding into utilities' transmission systems.[158] As a way to encourage larger and more cost-effective arrays of distributed solar deployment, the decision also requires utilities to make solar available to residents of multitenant buildings through "virtual net metering" and "net metering aggregation" and allows larger solar arrays greater than 1 MW to earn NEM credits. This larger-scale distributed solar model and new forms of procurement that are delinked from individual property owners may facilitate the adoption of labor standards and improve equity of access to solar. And in a nod towards equity, CPUC also tasked its own staff with resolving equity issues in rate design for residential customers in disadvantaged communities.

Given the political influence of labor and EJ groups in policy and regulation for low-carbon electricity markets, equity considerations can help shape how the solar and utility industries innovate and change.

Already, new models present opportunities to address equity issues more comprehensively, as well. The next section concludes this case study by highlighting how EJ and labor can help advance equity in the various solar deployment models.

3.2.3 Advancing Equity Across Solar Energy Deployment Models

Translating equity goals into concrete strategies across different solar deployment models requires multiple approaches, given that each model has different strengths in terms of equity and efficiency. Above all, the advancement of equity in solar deployment requires ensuring that two equity goals—expanding benefits of solar to low-income communities and increasing family-supporting, career-track jobs—are built into all models of solar deployment.

Utility-scale solar projects will continue to produce family-supporting union jobs as the 50-percent RPS is implemented. Utility-scale solar is much cheaper than small-scale solar, so it could exert a positive influence on utility bill cost containment. Utility-scale solar could have a more verifiable and, perhaps, larger impact on equity if there were specific goals for hiring of workers from targeted groups and mechanisms to track who is hired. Hiring goals and tracking systems are now commonly included in project labor agreements and community benefit agreements for large developments in many public works projects across the state. They could be adopted for all projects eligible to be counted in the RPS.

Distributed solar projects can be deployed in a way that favors more good jobs.[159] Mandates and public or ratepayer investments for distributed solar on public works projects[160] could increase solar installation on buildings in MUSH (municipal, university, school, and hospital) markets as well as publicly subsidized multifamily affordable housing, ensuring that the beneficiaries of California's solar investments are the public at large, rather than the higher-income segment of the population. Since contractors on public works projects must pay prevailing wages and utilize apprentices for a minimum percentage of work hours, the jobs created by such projects would be family-supporting, career-track jobs. One good example of this type of effort is Proposition 39, which directs up to $550 million annually for five years to energy efficiency and clean energy projects for K–12 public schools and community colleges. To participate in this program, contractors and subcontractors are required to comply with public labor codes.

Community-shared solar (CSS) is an emerging model for solar deployment that has the potential to advance equity and to expand the solar market customer base dramatically. Breaking out of the mold of either utility-scale solar farms or individual solar rooftop projects, community solar projects are usually in the mid-sized range, generating from 1 to 20 MW. EJ groups generally advocate for 1 to 5 MW due to their concern about ensuring placement in disadvantaged communities, while labor generally advocates for slightly larger community-scale solar because they have stronger relationships with larger developers. Despite this difference in emphasis, both recognize that this scale represents an underdeveloped "sweet spot" for

advancing distributed generation, as the projects can be sited on brownfield locations in urban areas closer to users but be much more cost-effective and have greater reach than solar projects for individual homes or businesses. Their larger scale, lower cost, and procurement models that are decoupled from individual property owners also make it easier to incorporate the wage and training standards common to utility-scale solar farms. Nationwide, the community solar market has the potential to increase photovoltaic deployment by 5.5 GW to 11 GW from 2015 to 2020, representing a sizeable impact on GHG reductions.[161]

Community-shared solar (CSS) is an emerging model for solar deployment that has the potential to advance equity and to expand the solar market customer base dramatically.

The time is particularly ripe for Community Shared Solar (CSS) programs that can incorporate some of the advantages of both utility-scale and local solar and offer fertile ground for meeting both EJ and labor interests. CSS models can take many different forms, involving a grouping of solar companies, property owners with space for local solar arrays, and utility customers, but they are usually a utility-run program in which multiple residential and commercial energy consumers subscribe to a single mid-sized solar array. Typically, participants receive a monthly bill credit for the electricity generated by their share of the solar system they subscribe to, but the system does not have to be located on their premises. This arrangement provides distributed solar access and benefits to customers who lack sufficient solar resources (too small a roof, shading, do not own their homes, unable to install solar for financial or other reasons). And because they are administered by a utility and/or require governmental approval, procurement contract solicitations are more likely to consider job and other co-benefits.

Nationwide, community solar programs are on the rise. At least 93 community solar programs are currently active in the United States, 77 of which are utility managed, while 16 are managed by a third party.[162] Utility programs are designed to leverage the technological benefits of distributed generation for the grid, including strategic locational deployment, advanced inverters, and storage technologies, while increasing access to a broader set of utility customers, including low-income customers and those with suboptimal credit scores or unsuitable building infrastructure.

IBEW Local 569

CPUC's recent decision regarding virtual net metering (VNM) creates a supportive environment for community solar programs. VNM means that even if electricity is not directly interconnected to a consumer's electricity meter, the household can still receive on-bill credits. This way, multiple customers can offset their electricity loads from a system located elsewhere. Senate Bill 43 requires IOUs to expand access to renewable energy resources for ratepayers who cannot yet access the benefits of on-site, local solar generation through a Green Tariff Shared Renewables Program administered by IOUs. The statute allows utilities to develop smaller-scale renewables and sell the generation in green premium-like programs, until there is 600 MW of customer participation statewide.[163] One program where such standards have a good chance of being incorporated is the LADWP Community Solar Program, where the RePower LA coalition continues to urge attention to the equity issue.

In sum, both energy efficiency and solar development offer a variety of opportunities to promote equity while advancing GHG emissions reductions. These case studies show how the criteria in the Climate Policy Equity Framework can be used to design and evaluate specific strategies with these multiple goals in mind.

4. Recommendations for Building Equity in Climate Policy

In this section, we present recommendations for building a policy package that aligns with the Climate Policy Equity Framework and could be a component of a social contract to govern California's transition to a low-carbon economy.

These recommendations are informed by: the Climate Policy Equity Framework and the indicators presented in Section 2, "The Climate Policy Equity Framework"; the strategies for designing policy programs discussed in the case studies of Section 3, "Finding Common Ground for Advancing Equity in Climate Policy"; ideas that emerged in a number of joint meetings among EJ and labor advocates over the last several years; and discussions in a workshop that the authors organized in March 2016 in Oakland, California. This workshop convened some of state's most active climate policy advocates working in community-based, environmental justice, and labor organizations to solicit feedback on this report and the Climate Equity Policy Framework. Participants at the meeting discussed ways to advance equity in three sectors: solar deployment; energy efficiency retrofits; and sustainable community planning. Although by no means an exhaustive list of equity recommendations for all GHG reduction programs developed under AB 32, the following recommendations exemplify significant opportunities to advance equity in the areas of immediate concern to EJ and labor groups. While participants did not officially endorse these recommendations on behalf of their organizations, the workshop served as an informal vetting process for policies that resonated with both EJ and labor organizations.

1. Require labor standards on construction projects that the state funds, incentivizes, or mandates to meet GHG reduction targets.

Labor standards—including prevailing wage, benefit, and skilled labor or apprenticeship standards—are crucial mechanisms for ensuring that low-carbon economic development results in high-quality, family-supporting careers. Labor standards are often linked with targeted/local hire provisions to broaden access to career-track jobs for disadvantaged workers. A number of vehicles exist for attaching labor standards to state GHG reduction measures that involve construction work.

Energy Efficiency and Distributed Generation Incentive Programs:

Implement labor standards for renewable energy, energy efficiency, and other low-carbon construction projects subsidized by public investment and utility ratepayer incentive programs.

Where work is in the non-residential sector and multifamily residential sector, apply prevailing wage and apprenticeship standards. For single-family residential projects, establish a living wage floor and industry-recognized skill certifications, where they exist. Vehicles to establish these standards can include responsible contractor language in competitive solicitations for third-party program administrators and participation requirements for contractors in rebate programs, etc.

Greenhouse Gas Reduction Fund (GGRF), Proposition 39, and Other Public Investment Programs:

Require a CWA, or similar arrangements that include labor standards and targeted/local hire provisions, on fully subsidized public and ratepayer investments in low-carbon sectors.

The agreements should include wage and skill standards as above, targeted hire policies and training programs to broaden job access, and training and career opportunities for workers from disadvantaged communities. Vehicles to establish these standards include competitive solicitations that require or give preference to contractors that already participate in or are willing to develop CWA workforce strategies.

Power Purchase Agreements (PPAs) for the Renewable Portfolio Standard (RPS):

Require a community workforce agreement (CWA) on RPS-eligible utility-scale renewables in power purchase contracts. Alternatively, give preference in the PPA selection process to projects with a multi-craft CWA.

The agreements should include wage and skill standards as above, targeted hire policies and training programs to broaden job access, and training and career opportunities for workers from disadvantaged communities.

Low-Income Weatherization Programs:

Require a wage floor and build career ladders for low-income energy efficiency retrofit programs funded by the utilities and the GGRF.

Replicate the LADWP weatherization program's workforce strategy through a competitive solicitation for program administrators and/or contractors who have established or can establish earn-while-you-learn training and pipelines to apprenticeship or other career-track job opportunities.

2. Invest in GHG-reducing public works projects that reach low-income Californians.

IBEW Local 569

Prioritizing low-carbon investments in the public sector (e.g., public buildings and public infrastructure projects) offers a variety of equity benefits by providing a vehicle for CWAs (see Recommendation 1) and ensuring direct investment in disadvantaged communities, while meeting GHG reduction goals.

MUSH Sector Energy Efficiency and Clean Energy Investments:

Create a comprehensive deep retrofit program for MUSH (municipal, university, school, and hospital) and affordable multifamily housing markets.

This program should use a CWA to ensure job quality and job access and prioritize facilities based on both their efficiency potential and their location in disadvantaged communities. By providing a full range of services and support to overcome barriers and aggregating projects so that participating contractors are guaranteed enough work to make participation worth their while, the MUSH sector can be a leading contributor to the state's new goal of doubling energy savings by 2030. Existing funding sources include ratepayer, Prop. 39, and GGRF funds.

Green Zones:

Support comprehensive GHG reduction and community resilience investments in the most disadvantaged communities, devised through a multi-stakeholder community engagement process that includes both environmental justice and labor organizations.

A number of recent proposals aim to help California achieve climate goals through comprehensive grants for economic development and pollution cleanup projects in the hardest hit communities. This concentrated public investment is designed to contribute to GHG reduction and provide larger impacts in co-benefits (e.g., local economic, workforce, environmental, and health benefits) for disadvantaged communities. These bills (AB 2722, the Transformative Climate Communities Act, and AB 1000, the Planning for Healthy Communities Act) shift focus from "access to benefits" from a variety of programs to comprehensive and coordinated green infrastructure investments. For example, a Green Zone could entail a community-led plan and community benefit agreements for co-siting community solar programs, transit-oriented development, and affordable housing developments.

3. Ensure equitable distribution of ratepayer and public incentive funds for private low-carbon investments.

Equity can be advanced by ensuring that programs to encourage adoption of solar, electric vehicle (EV), and other low-carbon technologies do not require participants to be homeowners, have disposable savings, or have access to credit in order to benefit from government incentives. To counteract the (unintended) regressive distribution of incentives for rooftop solar, EV, and energy efficiency, California has carved out subsidies for low-income households through the Multifamily Affordable Housing Solar Roofs Program, the Charge Ahead EV program, and low-income weatherization programs. Another approach is to design delivery of low-carbon goods and services in a way that decouples them from ownership of individual assets like homes or vehicles.

Community Solar Programs:

Expand community solar programs that provide distributed solar to multiple households (including pass-through benefits to renters), prioritize participation from disadvantaged households and siting in disadvantaged areas, and require the incorporation of CWAs.

The traditional rooftop solar model is geared for homeowners only and tends to exclude low-income customers, but community solar programs can expand solar options to low-income consumers by decoupling the siting of solar panels from the utility customers' residence or place of business. Under SB 43, IOUs are now required to implement 600 MW worth of community solar programs, with 100 MW of programs sited in disadvantaged communities identified by the CalEnviroScreen 2.0. These programs should be leveraged to improve equity outcomes by incorporating CWAs to ensure job quality and broaden access to career-track jobs. One such community solar model is under development by LADWP, which has so far focused on siting solar panels on utility-owned property in disadvantaged neighborhoods and expanding solar options to low-income customers, where advocates have proposed a CWA.

4. Ensure just transitions for workers and communities affected by the decline of GHG-emitting industries.

California is unlikely to lose jobs in the short term, but as we approach the stringent GHG reduction targets set for 2050, the risk of job loss may grow, particularly in sectors that are inextricably linked to fossil fuels, like oil and gas extraction and refining. Advanced planning to design a path for affected workers and communities can ease the process of transition and contribute to a more equitable outcome that mitigates the losses due to transition and addresses the long-term, adverse effects of fossil fuel production for frontline communities.

Industrial Planning for High GHG-Emitting Industries:

Identify a lead state agency and a funding source and initiate an inclusive planning process to mitigate transition losses for workers and communities potentially impacted by industrial decline due to climate policy.

This process should analyze risks of industry decline and involve both labor and disadvantaged communities in planning workforce transition strategies, assistance to workers and communities, and environmental cleanup of fossil fuel industries.

5. Ensure that cap and trade does not exacerbate pollution hotspots in disadvantaged communities and amend the program where necessary.

Ongoing evaluation of the cap-and-trade system is critical for determining whether the state's primary mechanism to reduce industrial emissions is exacerbating existing environmental justice hotspots. CARB has developed an Adaptive Management Plan that proposes to evaluate the distribution of emissions over time at individual cap-and-trade facilities in order to determine if adverse impacts are occurring at the neighborhood level. Where necessary, CARB will respond with proposed amendments to cap-and-trade regulations and related air quality permitting rules. Adequate reporting and rapid response are critical to this endeavor if hot spots are exacerbated.

LADWP and IBEW Local 18's Utility Pre-Craft Trainee

Incorporation of Co-Pollutant Emissions into CARB's GHG Emissions Mapping Tool:

CARB's current approach to adaptive management relies on its publicly available interactive GHG Emissions Mapping Tool, which enables the monitoring of GHG emissions changes at individual facilities, in California communities, and across industrial sectors.[164] However, the mapping tool does not include information on facility-level co-pollutant emissions (i.e., air toxics and criteria air pollutants) that cause adverse health effects in environmental justice communities living in close proximity to one or more of these facilities. Since GHG emissions are usually accompanied by releases of co-pollutants, an accurate evaluation of cap and trade's impact on

vulnerable communities requires that this information tool incorporate co-pollutant emissions. Data sets on co-pollutants already exist, but GHG emissions data and reports do not include facility-level identifiers that make it possible to link these separate data sets.

Public Reporting of Cap-and-Trade Transactions by Facility:

CARB should also publicly report the transactions of individual cap-and-trade facilities on an annual basis, including permit auctions, sales, trades, and offset purchases. With this information, regulators and affected stakeholders can see how certain types of transactions affect the location of air pollution emissions. Such analysis is critical to understanding the efficacy of the current cap-and-trade design in protecting low-income and minority communities hit hardest by concentrated pollution.

Restrictions on Facility-Level Trading and Offset Purchases Where Needed:

The CARB Adaptive Management Plan should amend the cap-and-trade program if and when data indicates that capped entities in disadvantaged communities have maintained or increased local emissions and co-pollutants. Course corrections should include regulatory amendments that restrict trading or mandate direct emission reductions at facilities in prioritized EJ communities. This objective could be accomplished through zonal restrictions on trading (similar to the RECLAIM program in Southern California[165]) and a decrease in the percentage of offsets that these facilities can purchase in each compliance period. CARB should also limit the offsets available for purchase by these facilities to activities that reduce emissions in EJ communities, for example, urban tree planting or solar energy programs certified by the state to sell offsets.

6. Ensure participation from labor and EJ representatives in all climate policy arenas.

California can build on a strong track record of public participation by filling in the following gaps and incorporating the multiple equity criteria in its public processes.

Inclusion of Both Labor and Environmental Justice Voices in State Bodies Responsible for Implementing Climate Policy:

Fill gaps in labor and EJ representation on state bodies (such as CARB, CPUC, and CEC) tasked with decision-making and implementation related to AB 32 and other climate legislation.

Just as CARB and the Strategic Growth Council have carve-outs for representatives that give voice to EJ interests, it is important for these bodies to have labor voices, given the increasing attention to job quality, job access, and workforce development outcomes. The Green Collar Jobs Council in the Labor Agency represents an important vehicle for increasing the voices of labor and economic justice organizations but requires renewed agency staffing and authority to participate in and shape key decision-making bodies (e.g., requiring groups like CARB and SGC to obtain their input on job-related matters).

Participatory Planning for the Sustainable Communities and Climate Protection Act (SB 375):

Implement a statewide participatory planning framework that clarifies a standard process for Metropolitan Planning Organizations (MPOs) developing a Sustainable Community Strategy (SCS) to reduce the carbon footprint of urban development as mandated in SB 375.

Key requirements of such a framework should include: (1) participation of representatives from EJ groups, labor unions, and other equity organizations in setting measurable equity performance goals to be achieved by the SCS; (2) monitoring of progress towards those goals at the city and county levels by the Strategic Growth Council or some other strategic executive body; (3) allocation of state resources on the basis of progress towards these equity performance goals and outcomes; (4) a funding source to support implementation of these requirements. The equity goals presented in the Climate Policy Equity Framework provide a good starting place for setting measurable equity performance goals.

Building a social contract for the transition to a low-carbon economy requires agreement among political actors about goals and strategies. Social contracts are not policies—although they are supported by policies—they are agreements between social sectors to work together and work through conflict. . . . We hope that this report and the Climate Policy Equity Framework not only contribute to policy, but also encourage productive conversations to address ongoing trade-offs and foster creative solutions.

7. Monitor equity performance across California's climate policies and programs.

California should monitor equity performance across all of its climate policies and programs. Existing California law requires state agencies to submit an annual status report to the Secretary for Environmental Protection that includes, among other things, a list of measures that have been adopted and implemented by that state agency to meet GHG reduction targets and the actual GHG emissions reduced as a result of those measures. This requirement should be expanded to collect consistent, reliable, and publicly available data to monitor performance on key equity indicators.

Statewide Public Accountability System to Track Equity Outcomes:

The state should develop an annual Climate Equity Report based on tracking equity outcomes to enable state officials to monitor whether equity goals have been reached and to identify areas where climate policy should be improved to advance equity.

This report would also allow concerned constituencies to hold public bodies accountable for progress on equity in GHG reduction measures. The statewide public accountability system for equity in climate policy would collect and assess data on the following equity outcomes:

a) Pollution reduction in environmental justice hotspots (see Recommendation 5);

b) Jobs tracking that includes number of jobs, job quality (wages, benefits, and career ladders), and access to jobs (demographic and geographic profile of workforce); and

c) Distribution of public and ratepayer investment for GHG reduction activities by income and wealth classification and geography.

Expand CalEnviroScreen 2.0:

The next version of the state's cumulative impacts screening tool should include geospatial data on climate vulnerability and low-wage work trends.

We have noted that the CalEnviroScreen tool provides a very good first step to defining EJ communities. However, because the tool is based on scoring census tracts, there is potential for smaller neighborhoods to be obscured in such a geographic grouping. In addition, without any indicators or metrics on climate vulnerability (as opposed to general environmental hazards and socioeconomic status), the tool will also hide the communities that are most at risk of suffering disproportionate impacts from the climate gap. Such a climate layer is possible; one was built into the newest version of the Environmental Justice Screening Method, and researchers in the California Department of Public Health have advanced work in this vein.[166] There are also significant challenges to tracking investments, the costs of goods and services, and the profile of employment in new sectors. However, in a state that prides itself on being at the forefront of information technology, resolving these data gaps is within reach.

With the climate crisis brewing, the Golden State stands poised for an energy revolution and massive reworking of the state's built infrastructure. At stake, as well, is our social infrastructure: whether we will generate the high-quality employment and access to a clean environment that has long been a key part of the California Dream. To build on our significant progress, we need a bigger and broader movement concerned about both economic and environmental equity, one that can effectively counter backward-looking business interests that oppose climate policy but collaborate with business, civic, and agency leaders who support action. And to do this, we need the environmental justice and labor movements to model the sort of coming together that creates broad and ongoing political support for a more sustainable and equitable California.

Building a social contract for the transition to a low-carbon economy requires agreement among political actors about goals and strategies. Social contracts are not policies—although they are supported by policies—they are agreements between social sectors to work together and work through conflict. In order to achieve equity and environmental improvements, we require a new set of agreements among actors, which include environmentalists, business, labor, environmental justice, and other stakeholders. And for equity to truly be represented in this broader coalition, we need a closer connection between the two main equity actors: labor and environmental justice organizations. We hope that this report and the Climate Policy Equity Framework not only contribute to policy, but also encourage productive conversations to address ongoing trade-offs and foster creative solutions.

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[58] Some scholars have focused on race or income levels as the most important determinant for defining "environmental justice communities." Others consider an environmental justice community to be one that has self identified as such and has protested or engaged in civic action about their plight.

[59] "[Ninety-one] deaths would be avoided for the year 2020 from implementation of the LCFS and ADF regulations." California Air Resources Board, "Staff Report: Initial Statement of Reasons for Rulemaking: Proposed Re-Adoption of the Low Carbon Fuel Standard Regulation," January 2, 2015, p. iv-9, http://www.arb.ca.gov/regact/2015/lcfs2015/lcfs15isor.pdf.

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[62] According to CARB spokesman David Clegern: "We have a whole array of programs that deal with a variety of different kinds of contaminants…and we don't want people to somehow get into a mind-set where they think that AB 32 is the tool they have to use to deal with those." See Madeline Ostrander, "Will California's Cap and Trade Be Fair?" *The Nation*, March 20, 2013, https://www.thenation.com/article/will-californias-cap-and-trade-be-fair/.

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[70] Policies include a federal tax credit on the cost of residential solar installation; capacity-based rebates available under the California Solar Initiative (CSI), a state program that ran from 2007 to 2013; and the structure of retail electricity prices, including net metering policies.

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[72] For example, among California PG&E customers (the utility with the largest number of residential solar customers in California), 70 percent of solar installations from 2007 to 2013 (which represented nearly half of all U.S. installations in 2007–2011) were adopted by the most affluent ratepayer category. See Severin Borenstein, "Private Net Benefits of Residential Solar PV: The Role of Electricity Tariffs, Tax Incentives and Rebates," UC Berkeley Energy Institute at Haas working paper, July 2015, https://ei.haas.berkeley.edu/research/papers/WP259.pdf.

[73] Erin Baker, Meredith Fowlie, Derek Lemoine, and Stanley S. Reynolds Baker, "The Economics of Solar Electricity," UC Berkeley Energy Institute at Haas working paper, April 2013, https://ei.haas.berkeley.edu/research/papers/WP240R.pdf; M.A. Cohen, P.A. Kauzmann, and D.S. Callaway, "Economic Effects of Distributed PV Generation on California's Distribution System," UC Berkeley Energy Institute at Haas working paper, June 2015, https://ei.haas.berkeley.edu/research/papers/WP260.pdf.

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[112] Sze et al., "Best in Show?"

[113] See London et al. "Racing Climate Change." The case is called *Association of Irritated Residents, et al. v. California Air Resources Board.*

[114] See Russak, "Advantaging Communities," which describes the vast network of grassroots EJ advocacy efforts across the state. Statewide coalitions such as the California Environmental Justice Alliance (CEJA) and the Asian Pacific Environmental Network (APEN), which also works locally in the East Bay, have grown out of the efforts of many experienced and accomplished grassroots EJ organizations, including the Center for Community Action and Environmental Justice (CCAEJ) in the Inland Valley areas of San Bernardino and Riverside Counties; the Center on Race, Poverty and the Environment (CRPE) in the San Joaquin Valley; the Central Coast Alliance United for a Sustainable Economy (CAUSE) in the Central Coast counties; Communities for a Better Environment (CBE) and Communities for a Safe Environment (CFASE) in Wilmington (CBE is also in the East Bay); East Yard Communities for Environmental Justice (EYCEJ) in the City of Commerce; Pacoima Beautiful; People Organizing to Demand Environmental and Economic Rights (PODER) in San Francisco; and Strategic Concepts in Organizing and Policy Education (SCOPE) and TRUST South LA, both in South Los Angeles.

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[121] *Climate Benefits for California* (website), https://www.climatebenefitsca.org/.

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[123] This was the main message of two studies mandated by CPUC in 2011 and 2014 whose recommendations have been taken up by labor and some EJ groups in CPUC and CEC proceedings. In addition to building a skilled workforce, the apprenticeship architecture helps to calibrate the workforce size to match the actual availability of jobs, avoiding a situation where there are too many trainees and not enough jobs.

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[131] Scott and Zabin, "Training for the Future II."

[132] Avis and Zabin, "Training for the Future," p. 10.

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[135] Ibid. See also Zabin et al., "Workforce Issues and Energy Efficiency Programs," Appendix 2b.

[136] For a review of the research on work quality, see ibid. And see also note 133.

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[138] California Public Utilities Commission, "Assigned Commissioner's Ruling Introducing a Draft Regulatory Incentives Proposal for Discussion and Comment," April 4, 2016, http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M159/K702/159702148.PDF.

[139] Jones et al., "The Link Between Good Jobs and a Low Carbon Future."

[140] Ibid.

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[143] Tim Drew, James Loewen, Shannon O'Rourke, Jason Perkins, Ehren Seybert, and Sara Kamins, "California Solar Initiative Annual Program Assessment," California Public Utilities Commission, June 2014, http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6920.

[144] Borenstein, "Private Net Benefits of Residential Solar PV."

[145] Costs of utility-scale solar power purchase agreements in 2015 were mostly in the range of $0.05 per kWh, and some as low as $0.03, as reported in Mark Bolinger and Joachim Seel, "Utility-Scale Solar 2015: An Empirical Analysis of Project Cost, Performance, and Pricing Trends in the United States," Lawrence Berkeley National Laboratory and U.S. Department of Energy, August 2016, https://emp.lbl.gov/publications/utility-scale-solar-2015-empirical?utm_source=newsletter28&utm_medium=email&utm_campaign=Constant Contact. Also, research done by the Brattle Group for First Solar shows that the cost of utility-scale solar comes to between $0.066 and $0.117 per kWh, customer-owned rooftop solar is between $0.123 and $0.193 per kWh, and for customer-leased rooftop solar, the cost is reportedly between $0.14 and $0.237 per kWh. See Bruce Tsuchida, Sanem Sergici, Bob Mudge, Will Gorman, Peter Fox-Penner, and Jens Schoene, "Comparative Generation Costs of Utility-Scale and Residential-Scale PV in Xcel Energy Colorado's Service Area," The Brattle Group, report prepared for First Solar, July

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[146] Borenstein, "Private Net Benefits of Residential Solar PV." Rooftop solar is still cheaper for some customers, particularly larger energy users (who are often more affluent) because they can recoup installation costs through NEM.

[147] For example, researchers estimate that 300 MW of PV solar deployed in a utility-scale configuration avoids approximately 50 percent more carbon emissions than an equivalent amount of residential-scale PV solar. See Tsuchida et al., "Comparative Generation Costs of Utility-Scale and Residential-Scale PV."

[148] In calculating the emission reductions, CARB accounts for the avoided line losses by assuming a 7.8-percent avoided line loss for in-state electricity saved. This line loss is used in calculating the additional savings associated with programs through the avoided line losses for CHP, photovoltaic solar, energy efficiency, and the renewables programs. See Lana Wong, "A Review of Transmission Losses in Planning Studies," California Energy Commission, August 2011, http://www.energy.ca.gov/2011publications/CEC-200-2011-009/CEC-200-2011-009.pdf.

[149] See the *Desert Renewable Energy Conservation Plan (DRECP)* website, http://www.drecp.org/.

[150] IBEW Local 569, "IBEW Local 569 Local Hire Successes: Imperial Clean Energy Projects," power point presentation, Imperial County Board of Supervisors, June 4, 2013; IBEW Local 569, "Clean Energy Creates Union Careers in Imperial County," YouTube video, 5 min., posted April 19, 2013, https://www.youtube.com/watch?v=mXQpE4yu9zc.

[151] Ben Russak, "Advantaging Communities: Co-Benefits and Community Engagement in the Greenhouse Gas Reduction Fund," UCLA Institute for Research on Labor and Employment, IRLE Reports, September 2015, http://escholarship.org/uc/item/4bt5s9qd.

[152] Ashley M. Shaw, California Workforce Development Board, email message to author, August 9, 2016.

[153] Thus, distributed solar installations lower the denominator of the 50-percent RPS—total retail sales of electricity—but are not also counted in the numerator (i.e., renewable installations counted for RPS compliance, except for those installations that are designated as renewable energy credits, RECs). This circumstance pitted unions and large-scale solar installers against rooftop solar companies and IOUs that came together (despite previous clashes over NEM policy) to lobby for changing the RPS to carve out a larger proportion of RECs for distributed rooftop solar. SB 350 will allow for the continued growth of utility-scale solar deployment and union-quality jobs. However, the law also requires CPUC to consider the benefits of rooftop solar and gives CPUC the authority to require utilities to procure some percent of their retail sales from rooftop solar to meet local electricity needs.

[154] They included the CPUC's Office of Ratepayer Advocates (ORA), the California Solar Energy Industries Association (CalSEIA), the national Solar Energy Industries Association (SEIA), the solar advocacy group VoteSolar, the Sierra Club, concerned federal agencies, The Alliance for Solar Choice (TASC), and the Natural Resources Defense Council.

[155] This approach is lauded by development organizations in developing countries where poor communities that are otherwise dependent on burning charcoal and wood—fuel sources that contribute to deforestation and local pollution—have gained access to electricity by forming "mini grids." Peter Alstone, Dimitry Gershenson, and Daniel M. Kammen, "Decentralized energy systems for clean electricity access," *Nature Climate Change* 5 (2015): 305-314. See also Glen Martin, "Welcome to the Decentralized Energy Revolution: Cleanly Electrifying the World," *California Magazine* (website), April 7, 2015, http://alumni.berkeley.edu/california-magazine/just-in/2015-04-07/welcome-decentralized-energy-revolution-cleanly-electrifying.

[156] Julia Pyper, "How Georgia Power's Solar Service Could Foster a New Utility Business Model," *Greentech Media* (website), October 9, 2015, http://www.greentechmedia.com/articles/read/how-georgia-powers-solar-service-could-foster-a-new-utility-business-model.

[157] California Public Utilities Commission, "Assigned Commissioner's Ruling Introducing a Draft Regulatory Incentives Proposal for Discussion and Comment."

[158] For 2019, CPUC staff need to do further analysis on alternative compensation structures, including "an export compensation rate that takes into account locational and time-differentiated values of customer-sited DG." The commission wants further information on "complementary policies to increase the value of customer-sited renewable DG." See California Public Utilities Commission, "Decision Adopting Successor to Net Energy Metering Tariff," January 28, 2016, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M158/K060/158060623.pdf.

[159] Betony Jones, "Creating Opportunities for Good Jobs in Distributed Solar" *Raising the Bar* (blog), UC Berkeley Center for Labor Research and Education, August 27, 2015, http://laborcenter.berkeley.edu/creating-opportunities-for-good-jobs-in-distributed-solar/.

[160] As defined in Section 1720 of the California Labor Code: "Construction, alteration, demolition, installation, or repair work done under contract and paid for in whole or in part out of public funds, except work done directly by any public utility company pursuant to order of the Public Utilities Commission or other public authority." See California Labor Code, Section 1720-1743, http://www.leginfo.ca.gov/cgi-bin/displaycode?section=lab&group=01001-02000&file=1720-1743.

[161] Feldman et al., "Shared Solar."

[162] In 2015, four utilities began to offer rooftop solar leasing programs with utility-owned, customer-sited solar installations on residential rooftops: Arizona Public Service and Tucson Electric Power in Arizona; CPS Energy in San Antonio, Texas; and Wright-Hennepin Electric Cooperative in Minnesota. See Miriam Makyhoun, Ryan Edge, and Nick Esch, "Utility Solar Market Snapshot: Sustained Growth in 2014," Solar Electric Power Association, May 2015, https://www.solarelectricpower.org/media/322909/Solar-Market-Snapshot-2015-ver5.pdf.

[163] Customers will be able to check a box to have 50-percent or 100-percent renewables-generated electricity and will be compensated at the retail rate plus a time-of-delivery adjustment but will have to pay a renewable generation rate to cover administrative and other program costs. California Public Utilities Commission, "Decision Approving Green Tariff Shared Renewables Program for San Diego Gas & Electric Company, Pacific Gas and Electric Company, and Southern California Edison Company Pursuant to Senate Bill 43," February 2, 2015, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M146/K250/146250314.PDF.

[164] California Air Resources Board, "Cap-and-Trade Adaptive Management Discussion Guide."

[165] Shonkoff et al., "Minding the Climate Gap," p. 23.

[166] Paul English, Max Richardson, Rachel Morello-Frosh, Manuel Pastor, James Sadd, Galatea King, William Jesdale and Michael Jerrett, "Racial and Income Disparities in Relation to a Proposed Climate Change Vulnerability Screening Method for California," *The International Journal of Climate Change: Impacts and Responses* 4, no. 2 (2013): 1-18. Another improvement to CalEnviroScreen would be the addition of a jobs layer.

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