



CALIFORNIA, GREENHOUSE GAS REGULATION, AND CLIMATE CHANGE

CENTER FOR
DEMOGRAPHICS & POLICY
RESEARCH BRIEF
CHAPMAN UNIVERSITY

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“Demographics is destiny” has become somewhat overused as a phrase, but that does not reduce the critical importance of population trends to virtually every aspect of economic, social and political life. Concern over demographic trends has been heightened in recent years by several international trends—notably rapid aging, reduced fertility, large scale migration across borders. On the national level, shifts in attitude, generation and ethnicity have proven decisive in both the political realm and in the economic fortunes of regions and states.

The Center focuses on research and analysis of global, national and regional demographic trends and also looks into policies that might produce favorable demographic results over time. In addition, it involves Chapman students in demographic research under the supervision of the Center’s senior staff. Students work with the Center’s director and engage in research that will serve them well as they look to develop their careers in business, the social sciences and the arts. They have access to our advisory board, which includes distinguished Chapman faculty and major demographic scholars from across the country and the world.

AUTHORS

David Friedman and Jennifer Hernandez are attorneys in the West Coast land use and environment practice group of Holland & Knight LLC, an international law firm. The practice group periodically publishes analyses of California legal and policy data in support of its continued study of the use, and abuse, of the California Environmental Quality Act of 1970, which allows anyone (even anonymous entities, and entities such as business competitors and labor unions seeking to advance non-environmental objectives) to file a lawsuit alleging inadequate environmental evaluation of any type of project requiring any discretionary approval from any state, regional or local agency. As confirmed by several research studies including those completed by the firm, California courts have upheld approximately half of such CEQA lawsuit challenges in reported appellate court cases decided over the past 15 years, most commonly ordering reversal of project approvals pending further environmental studies. The top target of CEQA lawsuits statewide are housing projects located in existing California communities. More transit projects than roadway projects are sued under CEQA, and the most frequent “industrial” target of CEQA lawsuits are solar and wind projects. The delays and uncertainties caused by CEQA lawsuits against environmentally benign or even beneficial projects typically disqualify projects from receiving construction loans or government funding. While there have been repeated calls to end the use of CEQA lawsuits for non-environmental purposes, CEQA reform faces fierce opposition from entrenched special interests led by California’s environmental advocacy groups and some unions such as the Building Trades Council. Current Governor Jerry Brown has blamed unions for blocking CEQA reform, and was particularly critical of union reliance on CEQA lawsuits and lawsuit threats to leverage exclusive union member employment agreements from lawsuit targets. The authors’ most recent comprehensive study on statewide CEQA lawsuits was published in the Winter 2018 edition of the *Hastings Environmental Law Journal* in 2017, and is available here: <https://www.hklaw.com/publications/California-Environmental-Quality-Act-Lawsuits-and-Californias-Housing-Crisis-12-13-2017/>

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ACKNOWLEDGEMENTS

This report was written for the Center for Demographics and Policy which is funded by a generous contribution by Roger Hobbs. The Center is associated with the Chapman University School of Communication, Dr. Lisa Sparks, dean.



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SUMMARY

California has adopted the most extensive climate change policies, laws and regulations in the United States, and the state's climate leaders are routinely heralded for taking bold and generally unilateral action to reduce greenhouse gas (GHG) emissions within California's borders to combat climate change. Although California can also claim to be the fifth largest economy in the world if it were a separate nation, the state's actual GHG emissions account for less than 1% of the world's anthropogenic GHG emissions. Given the state's minuscule share of global GHG emissions, Governor Brown has often proclaimed that California's GHG reductions will be "meaningless" unless other states and countries can be persuaded to follow California's example.

This paper examines California's GHG reductions between 2007 (when the landmark Global Warming Solutions Act (AB 32) took effect), to 2017, when the California Air Resources Board adopted the most recent "Scoping Plan" prescribing existing and proposed new GHG reduction mandates (Scoping Plan) that CARB deems required to achieve the state's legislated mandate of reducing GHG 40% below the state's 1990 GHG emission inventory by 2030, and the unlegislated Executive Orders issued by the current and prior governor directing the state to achieve an 80% reduction in GHG by 2050.

This paper also examines the performance of California's economy as experienced by California residents, which presents a substantially different story than the aggregated statewide data used by CARB to conclude the state is enjoying a successful boom. In fact, California has the nation's highest poverty rate, and by far the largest number of Americans

living in poverty: about 8 million Californians, and more than 2 million children, live below the federal poverty level. California also has the nation's highest homeless rate, and again by far the largest number of homeless Americans, including more than a quarter of a million families, children, and adults. California's largest city, Los Angeles, counted more than 50,000 homeless individuals in 2017. California has a low unemployment rate, but extraordinarily high costs for basic necessities, including housing, electricity and transportation. For decades, California has also declined to authorize new housing construction, and experts as well as political candidates now concede that California now has a shortfall of about 3 million homes.

California's prioritization of climate change policies have resulted in disparate and damaging social and economic impacts for most Californians...

Although California's overall economy grew substantially since state leaders made climate change the state's top policy priority in 2007, the state expanded even more rapidly in the previous decade, and in a far more regionally and racially equitable pattern. During the last 10 years, as opposed to earlier economic growth patterns, California's economy has been disproportionately focused within the San Francisco Bay Area,¹ a region with just 16% of the state's population. The Bay Area's economic prosperity was, in turn, driven by a relative handful of technology and social media companies. A substantially disproportionate share of the new wealth created in California since 2007 was absorbed by more affluent Bay Area

white and, to a lesser extent, Asian workers and households in the Bay Area.

This paper shows that as housing and energy (electricity and transportation fuels) costs rose well above the national average, income growth for the remainder of Californians largely stagnated, particularly for Latino, African American and poorer, less educated workers and households. Homeownership rates also fell significantly, and are now especially low for the state's minority-majority and poorer, less educated population.

The paper concludes that California's prioritization of climate change policies have resulted in disparate and damaging social and economic impacts for most Californians, including the following:

1. The CARB Scoping Plan results in highly regressive cost burdens that particularly affect basic living expenses, including housing, transportation, heat and electricity for the state's historically disadvantaged, and now majority minority populations, as well as less affluent and educated residents in all demographic groups. The carbon-intensive activities of wealthier Californians, however, such as air travel and high-value, technologically complex consumer goods imported to and sold in California, receive scant, if any attention in the Scoping Plan.
2. California's climate costs are also disproportionately borne by those living outside the most temperate coastal climate zones in the state's largest employment hubs, such as San Francisco/Silicon Valley, and West Los Angeles County. The state's influential environmental movement is largely supported by wealthier residents in coastal regions where decades of "no growth" and "slow growth" policy advocacy --- and opposition to growth in peripheral areas adjacent to existing development or existing "backbone" infrastructure like major freeways -- has helped engender the nation's most severe housing shortages and highest prices. Only the very wealthy can afford to live in the parts of the state where energy costs for utilities and travel are substantially lower due to the mild climate and proximity to employment. In contrast, climate policy related energy cost increases have a much more damaging effect in California's inland regions, where winter and summer conditions are much more extreme than in coastal areas, and where Latino and less affluent households have increasingly clustered to find affordable housing. The state's inland population is also required to commute longer distances to work. Climate strategies that include intentionally increasing highway congestion in a failed attempt to persuade more people to commute by bus or, in some places, trains have not resulted in greater but less transit use. At the same time highly regressive transportation fuel price increases, force generally less affluent, minority-majority inland residents to disproportionately bear the greatest cost burdens for California's climate programs.
3. California's climate program also reduces the state's ability to generate higher wage jobs for residents without college degrees in manufacturing or other industries highly sensitive to energy and housing costs. This is a particularly important gateway to middle class income levels for the state's multi-decade educational decline including the increasing number of California residents who lack even a high school diploma. From 2007-2016, the number of adults 25 years and older with less than a high school diploma

fell by over 3.2 million in the rest of the U.S. but grew by about 6,000 in California. In 2016, nearly 18% of the state's adult population did not graduate from high school compared with 11.9% in the rest of the country.² Manufacturing jobs fell more rapidly in California during the 2007-2009 recession, and have recovered much more slowly. Since 2010, the rest of nation has generated over 855,000 new manufacturing jobs, an 8.4% increase, while California generated just 60,000 jobs, just a 4.8% growth rate.³

4. California's wealthy, coastal environmental advocates also routinely lobby to shut down or deny approvals of projects that would create working and middle class jobs, even when such jobs would help achieve global greenhouse gas reductions. For example, California has vast forest lands which can be managed to protect species and habitats, encourage tree growth to sequester carbon, produce electricity from wood-waste biomass fuels, create substantial jobs in poorer, inland regions of the state by manufacturing wood products, and lower housing production costs with locally-produced materials to build the three million homes that, as all leading California candidates for Governor agree, must be built to alleviate the state's housing crisis. Instead, environmental advocacy, litigation, and the resulting bureaucratic paralysis have created vast areas of mismanaged forest lands with dense underbrush and stunted tree growth uniquely susceptible to catastrophic wildfires that emit far more GHGs from combustion and the subsequent decay. Rather than facilitate the removal of dead trees and long term management required to sustain healthy forests that sequester GHGs in trees and plants, California has instead pursued policies

that increase the risk of death and property damage from forest fires, escalate funding for state fire fighters, and require California to import all of its building material wood products from China, Canada or other states.

5. Although California's climate programs include the allocation of at least some of the new, highly regressive GHG-related fees and taxes to assist poorer Californians affected by higher energy and housing costs, most of the available funding has benefitted the acquisition of rooftop solar and electric vehicles by wealthier residents comprising the top 20% of the state's income earners. Climate subsidy programs for poorer Californians, such as a \$200-300 million fund to help fund affordable housing, are particularly unimpressive when the cost of producing affordable housing in urban areas can exceed \$700,000 per unit.

In summary, the imposition by the state's Democratic party leaders of highly regressive climate schemes have engendered disparate financial hardships on middle and lower income workers and minority communities, while providing direct economic subsidies to wealthier Californians in environmentalist strongholds like Marin County. This represents a significant departure from more traditional Democratic party values.⁴

INTRODUCTION

California has adopted the most extensive climate change policies and regulations in the United States, starting with the landmark Global Warming Solutions Act legislation which took effect in 2007 (AB 32).⁵ The Act required that California reduce greenhouse (GHG) emissions to 1990 levels by 2020.

In 2016 the state legislature approved SB 32, which amended the Act to require that state emissions be reduced to 40% below 1990 levels by 2030.⁶

The most recent GHG inventory published by the California Air Resources Control Board (CARB) in 2017 estimates that GHG emissions covered by AB 32 and SB 32 were 440.4 million metric tons of carbon dioxide equivalent (MMT_{CO₂e}) in 2015.⁷ CARB has estimated that the state's 1990 emissions were 431 MMT_{CO₂e}. California will need to reduce GHG emissions by 9.4 MMT_{CO₂e} (2.1%) from 2015 levels to meet the state's 2020 goal, and by 181.8 MMT_{CO₂e} (41.2%) from 2015 levels to meet the state's 2030 goal. Based on CARB's 2015 estimate of 11.3 tons of CO₂e per capita, this means California must cut GHG emissions by 0.25 tons of CO₂e per capita by 2020, and by 4.7 tons of CO₂e per capita to about 6.6 tons of CO₂e per capita by 2030. As we will demonstrate below, this is well in excess of either the Paris agreements or policies adopted in other "model" jurisdictions such as Germany or the European Union.

In December 2017, CARB approved an updated "Scoping Plan" consisting of already-enacted, newly-proposed, and immediately-effective measures to achieve the legislated GHG reductions required for 2030. The Scoping Plan includes measures that go beyond the legislated 2030 GHG reduction mandate and further reduce state emissions to 80% below 1990 levels, or to about 2 tons of CO₂e per capita, by 2050.⁸

The Scoping Plan states that both the legislated statewide emission reductions for 2020 and 2030, and the unlegislated 2050 goals, are required for California to do its fair share under a 2015 convention between parties to the United Nations Framework Convention on Climate Change (UNFCCC), which is commonly known as the "Paris Agreement."⁹

The Agreement's central aim is to reduce anthropogenic global emissions of GHGs to levels that climate models developed by the Intergovernmental Panel on Climate Change (IPCC) and other researchers suggest will limit global temperature increases to less than 2 degrees Celsius, and potentially to 1.5 degrees Celsius, by 2100 compared with pre-industrial levels.¹⁰ The Scoping Plan states that it "reflects the same science that informs" the Paris Agreement,¹¹ "demonstrates that we are doing our part in the global effort under the Paris Agreement,"¹² and that California is "unleashing nonlinear transitions to clean energy and clean transportation technologies that will put California on the path to meeting our 2030 target and the goals of the Paris Agreement."¹³ In short, the Scoping Plan declares that the Paris Agreement "frames our path forward."¹⁴ As we will argue below, this is a vast exaggeration of the requirements of the Paris agreements and represents a kind of ideological hubris, given California minute contributions to global GHG.

CARB asserts that implementing the Scoping Plan will largely be costless and in fact can be expected to benefit the state's economy. Since the Global Warming Solutions Act was enacted, the Scoping Plan states that California "consistently outpaced economic growth in the rest of the country" and has "succeeded in reducing GHG emissions while also developing a cleaner, resilient economy."¹⁵ Looking forward, the Scoping Plan compares the gross state product, employment and personal income growth that would occur in 2030 under a "reference scenario," the state's projected patterns of growth, assuming all existing climate and related laws and regulations except the new measures included in the Scoping Plan remain in effect, with the results projected to occur from implementing the Scoping Plan's

additional GHG reduction measures. The Scoping Plan includes scores of measures, but the those expected to reduce GHG emissions the most include: (a) a legislated “cap and trade” emissions program with declining caps which is generally applicable to manufacturing and fossil fuel sectors; (b) a legislated increase in the electric power renewables portfolio standard (RPS) to 50% of all electricity generation; (c) various measures to reduce the carbon intensity of gasoline and other fuels by 18%; (d) improvements to freight system efficiency by 25%, and the planned deployment of 100,000 zero emission freight vehicles and equipment; (e) legislated reductions to state methane and hydrofluorocarbon emissions by 40%, and anthropogenic “black carbon” emissions, by 50% below 2013 levels; (f) deployment of 4.2 million zero emission vehicles, including plug-in hybrid electric, battery-electric, and hydrogen fuel cell vehicles; (g) doubling energy efficiency requirements for electricity and natural gas in homes and other uses discussed from the levels required in the California Energy Commission’s 2015 Integrated Energy Policy Report; and (h) various unlegislated measures to reduce vehicle miles traveled (VMT) by densifying housing development in existing urban areas, modifying other individual travel behaviors such as increased reliance on public transit, and requiring more stringent (e.g., “net zero GHG”) standards for new housing and land use projects and plans.¹⁶

According to CARB, economic projections show that in 2030, “the costs of transitioning to this lower carbon economy are small [and]...the California economy, employment, and personal income will continue to grow as California businesses and consumers make clean energy investments and improve efficiency and productivity to reduce energy costs.”¹⁷ In addition, the economic projections do “not

capture the impact of new technologies that may shift the economy and California in unanticipated ways or benefits related to changes in air pollution and improvements to human health, avoided environmental damages, and positive impacts to natural and working lands.” Consequently the economic impact analyses “likely underestimate the benefits of shifting to a clean energy economy.”¹⁸

Although California is not itself a party to the Paris Agreement, this paper demonstrates that the GHG reductions California proposes to achieve in 2030 are far greater than the reductions proposed by any of the actual parties to the Paris Agreement,¹⁹ including, for example, Germany and other European countries that have remained the most stalwart supporters of the Paris Agreement. Many European participants in the Paris Agreement are, in fact, revising or discarding country-specific GHG targets similar to the Scoping Plan approach in favor of regional and continental-scale emission reduction goals. Far from consistency with the most ardent supporters of the Paris Agreement, the Scoping Plan requires more than double the actual level of reductions that the European nations are willing to achieve by 2030 under the agreement. It also ignores opportunities to reduce emissions more rapidly, at less cost, and with far fewer socially undesirable consequences, at both a national level and within North America.

In contrast with the rest of the U.S., California is a “minority-majority” state. According to the U.S. Census Bureau, by 2016 white residents accounted for 38% of the state’s population compared with 64% of the total in the rest of the U.S. In California, Latinos (39% of the state’s population) are the state’s largest ethnic group, and nonwhite residents, including

Asians (14%) and African Americans (6%) comprise 62% of the total population, nearly double the percentage of non-white residents (36%) in the rest of the country.²⁰

The paper demonstrates that California's climate change policies, and their influence on other state legal requirements, such as the California Environmental Quality Act (CEQA) have significantly distorted the California economy and will likely continue to have a disparate effect on Latino, African-American as well as all poorer, less educated residents of all races and ethnicities. While California's economy grew since 2007, the state expanded even more rapidly, and in a far more balanced manner, in the preceding decade. During the last 10 years, California's economy has been disproportionately focused within the San Francisco Bay Area,²¹ a region with just 16% of the state's population, and driven by a relative handful of technology and social media companies. A substantially disproportionate share of the new wealth created in California since 2007 was enjoyed by the more affluent Bay Area white and, to a lesser extent, Asian workers and households in the Bay Area; Latino and African-Americans even in the Bay Area did not enjoy these gains. The impacts of higher housing and energy costs had even worse impacts on other, less economically fortunate locations, particularly for income growth among Latino, African American and poorer, less educated workers and households. Homeownership rates also fell significantly, and are now especially low for the state's minority-majority and poorer, less educated population. The reasons why California's climate change policies result in such disparate and damaging social and economic impacts include the following:

1. The Scoping Plan imposes highly regressive cost burdens that particularly affect basic living expenses, including housing, transportation, heat and electricity for the state's historically disadvantaged, and minority majority populations, as well as less affluent and educated residents in all demographic groups. The carbon-intensive activities of wealthier Californians, however, such as air travel and high-value, technologically complex consumer goods imported to and sold in California, receive scant, if any attention in the Scoping Plan.
2. California's climate costs are also disproportionately borne by those living outside the most temperate coastal climate zones in the state's largest employment hubs, such as San Francisco/Silicon Valley, and the western areas of Los Angeles, Orange and San Diego counties. Only the very wealthy can afford to live in the parts of the state where energy costs for utilities and travel are substantially lower due to the mild climate and proximity to employment. In contrast, climate policy related energy cost increases have a much more damaging effect in California's inland regions, where winter and summer conditions are much more extreme than in coastal areas,²² and where Latino and less affluent households have increasingly clustered to find affordable housing. The state's inland population is also required to commute longer distances to work. Climate strategies that include intentionally increasing highway congestion in a failed attempt to persuade more people to commute by bus, and highly regressive transportation fuel price increases, force generally less affluent, minority-majority inland residents to disproportionately bear the greatest cost and longest commutes in order to support California's climate programs.

3. California's climate program also reduces the state's ability to generate higher wage jobs for residents without college degrees in manufacturing or other industries that are highly sensitive to energy and housing costs. From 2007-2016, the number of adults 25 years and older with less than a high school diploma fell by over 3.2 million in the rest of the U.S. but grew by about 6,000 in California. In 2016, nearly 18% of the state's adult population did not graduate from high school compared with 11.9% in the rest of the country.²³ Manufacturing jobs fell more rapidly in California during the 2007-2009 recession, and have recovered much more slowly. Since 2010, the rest of nation has generated over 855,000 new manufacturing jobs, an 8.4% increase, while California generated just 60,000 jobs, just a 4.8% growth rate.²⁴

4. California's wealthy, coastal environmental advocates have blocked opportunities to create working and middle class jobs even when potential industrial expansion would help meet the state's climate goals. California has vast forest lands which can be managed to protect species and habitats, encourage tree growth to sequester carbon, produce electricity from wood-waste biomass fuels, create substantial jobs in poorer, inland regions of the state by manufacturing wood products, and lower housing production costs with locally-produced materials to build the three million homes that, as all leading California candidates for Governor agree, must be built to alleviate the state's housing crisis. Instead, environmental advocacy, litigation, and the resulting bureaucratic paralysis have created vast areas of mismanaged forest lands with dense underbrush and stunted tree growth uniquely susceptible to catastrophic wildfires that

emit far more GHGs from combustion and the subsequent decay, rather than renewal, of burnt lands. Recent estimates indicate that the magnitude of GHG emissions from the state's poorly-managed forests could amount to as much as 60% of California's total reported emissions in 2015.²⁵ Rather than facilitate the removal of dead trees and long term management required to sustain healthy forests that sequester GHGs in trees and plants, California has instead pursued policies that increase the risk of death and property damage from forest fires, escalate funding for state fire fighters, and require California to import all of its building material wood products from China, Canada or other states.

5. Although California's climate programs include the allocation of at least some of the new, highly regressive GHG-related fees and taxes to assist poorer Californians affected by higher energy and housing costs, most of the available funding has benefitted the acquisition of rooftop solar and luxury electric vehicles by wealthier residents. Climate subsidy programs for poorer Californians, such as a \$200-300 million fund to help fund affordable housing, are particularly unimpressive when the cost of producing affordable housing in urban areas can exceed \$700,000 per unit. Compared with an existing housing shortfall of more than 3.5 million units, the 2018 climate affordable housing subsidy of \$255 million would pay for less than 400 affordable units. Over 20 years, the climate subsidy might generate about 8,000 units, or 0.2% of the state's current housing deficit.²⁶

The imposition by the state's Democratic party leaders of highly regressive climate schemes that result in disparate financial

hardships on middle and lower income workers and minority communities while providing direct economic subsidies to wealthier Californians in environmentalist strongholds like Marin County, represents a significant departure from more traditional Democratic party values. According to several studies, as many as 40% of all Californians cannot regularly meet basic monthly expenses. The regressive new climate cost burdens on housing, transportation and electricity required by the Scoping Plan will only increase economic hardships, and reduce the quality of life, for these and a growing number of the state's residents.

Even more tragically, the steep price of Scoping Plan is unlikely to buy any real reduction in the global atmospheric concentration of GHG gases that is the only effective way to meet the Paris Agreement goals. California's policies are already driving residents and jobs to states with much higher GHG emissions. State policies also do nothing to address the importation of products and energy from countries with far less stringent GHG, environmental, worker protection, and human rights standards. This already well-developed pattern of net domestic out-migration and high-GHG product and energy importation in lieu of in-state manufacturing or generation directly undermines the goal of achieving net worldwide total, not just in-state GHG reductions. Despite its climate advocacy and large population (about 12% of the U.S. total), since 2007 many other states have achieved several times the per capita and total mass GHG emissions reductions that a decade of climate policies has failed to produce in California. Just four states--Ohio, Pennsylvania, Indiana and Georgia with a combined population almost identical to California--reduced total GHG emissions by five times the total amount that California achieved since 2007, but also

managed to maintain most energy costs below the national average, support over a million more manufacturing jobs, and foster a much higher homeownership rate.

It is critical to reiterate that climate change is a global phenomenon, and reducing GHG emissions globally is the objective of the Paris Agreement and California's climate laws. However, creating and expanding a large and permanent underclass while underperforming the emissions reductions that have been achieved in other states, most of which are not considered to be climate leaders, is unlikely to inspire other nations and communities to follow California's climate policy example.

Section I of this paper provides information about the Paris Agreement and the emissions that the UNFCCC projects will result in 2030 from the national commitments that have been made under the agreement. The analysis shows that California's 2030 reduction goals are much larger and are likely to have far more substantial costs and disparate impacts on disadvantaged and vulnerable populations than proposed by any party to the Paris Agreement, including the European Union (EU). While the EU, like the Scoping Plan, promises that GHG emissions will be reduced by 40% below 1990 levels by 2030, in 2015 the EU already claimed credit for more than half of the necessary reduction, largely as a result of the closure of highly inefficient power and manufacturing facilities in member states that were once within the former Soviet Union. In addition, the EU Paris Agreement commitment is specifically intended to be achieved on a collective, continental rather than a subnational basis. Many EU member states, including Germany, are moving away from unilateral to regional GHG emission strategies to address the disparate domestic and resulting political impacts of climate policies. The EU also allows for the use of nuclear, hydropower, and biomass fuel, including wood pellets made

from U.S. and other forests, to reduce total GHG emissions. California is either decommissioning these energy sources (e.g., nuclear) or has adopted policies that all but completely preclude the development of certain renewable energy technologies (e.g., hydropower and wood pellets).

Section II discusses the likelihood that California's unilateral climate change goals will actually reduce global emissions. The state imports about one-third of its electrical power and 95% of its natural gas from the rest of the country, and its most successful companies generate in-state wealth from activities, such as data centers in lower-cost locations like Kansas and manufacturing in China, which result in large out-of-state emissions. The state also imports goods and energy from other nations and states using dirtier, less efficient power sources that cannot be cost-effectively produced in California. The state's climate policies, in fact, contemplate a massive increase in battery materials production, such as cobalt and lithium, and lighter weight oil imports, that can only be obtained and manufactured in out of state locations, many of which allow for practices and policies that conflict with other state objectives, such as banning child labor, protecting the rights of women, gays and lesbians, and protecting the environment. The Scoping Plan also fails to address GHG emissions "leakage" from the shuffling, rather than curtailment of high GHG-emission energy and production, as well as the net outward migration of people and economic activity, to higher emission out-of-state locations. Finally, the Scoping Plan fails to identify a technologically feasible, carbon-free solution for the growing mismatch between the times that renewable wind and solar power are available and statewide demand, and does not sufficiently address major emissions sources,

such as commercial aviation and wildfires from forest mismanagement, that have a direct effect on the state's net emissions.

Section III discusses the economic consequences of state policies since the Global Warming Solutions Act became effective, including dramatic increases in real poverty rates that reflect costs of living, well above the national average, the exclusion of Latino, black and poorer white and Asian residents from the comparatively limited growth that occurred since 2007, and the state's deepening housing crisis. In 1997-2007, the economy created over 900,000 more jobs than during 2007-2017, and 96% of all new employment was located outside the Bay Area.²⁷ The state's official population in poverty fell from 5.46 million to 4.59 million. Since 2007, the Bay Area accounted for between 36% to 46% of total statewide job growth. Much of the Bay Area's economic expansion bypassed the rest of the state, while rising energy and housing costs adversely affected the welfare of a growing number of California residents. In 2016, the official number of people in poverty rose to 5.44 million, an increase of 850,000. Poverty measures that take into account the state's significantly higher costs, however, indicate that the real number of impoverished Californians in poverty actually ranges from 8 million to 9 million, by far the largest population in the country, and the highest percentage of people in poverty in any state.

These impacts can also be compared by race. By 2016, although the state's population of Latino and white residents was about the same, nearly half of all Latino households earned less than \$50,000 per year compared with just 32% of all white households. Home ownership rates fell from 58% to 54% in California compared with 64% in the rest of the country. In 2016, while California's white home

ownership rate was still above 62%, just 42% of all Latino households, and only 33% of all black households, owned their own homes. This is a far lower percentage than found in other states less identified with substantial minority populations, such as Texas, Tennessee, Florida and Arizona.

In our conclusion, we recommend that California policies focus on achieving significant but more cost effective and less socially adverse GHG reduction efforts, including much more active participation in national rather than unilateral, socially and economically regressive programs and policies, as well as compliance with traditional (pre-climate era) environmental rulemaking mandates that require full and frank disclosure of the costs and benefits to today's California residents, as well as to global efforts to reduce climate change. Forcing a million Californians to move to states with higher per capita GHG emissions to find housing they can afford, and eliminating gateway middle class, value-added jobs in energy dependent sectors like manufacturing that are accessible to people without college diplomas are fundamentally regressive and unfair. Similarly exporting such jobs to countries and states with less stringent environmental and labor laws, and ignoring California's "carbon footprint" in imported consumer goods and other unquantified sectors like forest products, both exacerbate California's poverty and housing crisis, while actually increasing global GHG emissions. We recommend a full reset – California Climate Leadership version 2.0, in the language of Silicon Valley – to restore California to economic health and meaningful environmental progress.

I. THE PARIS AGREEMENT AND CALIFORNIA'S "FAIR SHARE"

Despite repeated references to the Paris Agreement, the Scoping Plan never explains precisely why the state's emissions goals are necessary for "doing our part" under the agreement.²⁸ Nothing in the Paris Agreement requires that a party achieve a specific level of reductions by any specific date. And, in fact, no party to the Paris Agreement has pledged to achieve anything close to the magnitude of GHG reductions in the California Scoping Plan for 2030. Both the disproportionate size and the impacts of the Scoping Plan on disadvantaged communities are, in fact, inconsistent with the Paris Agreement.

A. BACKGROUND

The Paris Agreement emerged from the 21st UNFCCC convention of the parties (COP 21) in 2015 and implemented, for the first time, an international system for identifying and tracking compliance with GHG emission reductions. The agreement is based on widely accepted scientific evidence that human-related greenhouse gas emissions raise atmospheric concentrations of carbon dioxide and other gases that contribute to observed increases in global surface temperatures. According to the European Environment Agency, during 1850 to 2012, atmospheric carbon dioxide equivalent (CO₂e) concentrations rose from about 289 parts per million (ppm) to 449 ppm.²⁹

The IPCC has developed representative compliance pathways (RCPs), modelled scenarios that estimate how the earth's temperature may increase by 2100 in relation to potential future atmospheric CO₂e concentrations. The IPCC has also estimated potential risks and impacts from future temperature increases.

Based on these estimates, the parties to the Paris Agreement agreed to the goal of controlling future emissions in a manner that the IPCC climate models suggest could limit global temperatures to no more than 2 degrees Celsius, and potentially no more than 1.5 degree Celsius, above preindustrial levels as of the year 2100. The models indicate that, to remain within the RPC scenarios in which the IPCC estimates that the chances of achieving the 2 degree goal are at least “about as likely as not,” global emissions would need to be reduced from 2010 levels by 25% to 72% by 2050, and by 73% to 118% from 2010 levels by 2100.³⁰

The Paris Agreement requires that each party submit an intended “nationally determined contribution” (NDC) towards achieving the 2100 global temperature objective every five years. The Paris Agreement reserves the identification of each NDC to the discretion of each party, subject to several general considerations. Article 4 of the Agreement, for example, states that:

In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty... Each Party's successive nationally determined contribution will represent a progression beyond the Party's then current nationally determined contribution and reflect its highest possible ambition, reflecting its common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.

The agreement’s preamble states that it “takes into account” the need for a “just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities.” When taking action to address climate change, the preamble urges that the parties “respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity.” Finally, the agreement provides that developed country parties should take the lead by “undertaking economy-wide absolute emission reduction targets” while developing countries should enhance mitigation efforts and “move over time towards economy-wide emission reduction or limitation targets in the light of different national circumstances.”³¹

The Paris Agreement represents an important international milestone for addressing potential climate change risks over more than 80 years to 2100. Apart from requiring GHG reduction targets from “developed country parties” and encouraging that similar goals eventually by “developing country parties,” the agreement does not mandate the adoption of specific GHG reductions by any party. The NDCs are intended to be consistent with the agreement’s overall global temperature goal for 2100 but also reflect each party’s unique national circumstances, nationally-defined development priorities, and obligations to local communities, people in vulnerable situations and the achievement of other social and equity objectives.

B. THE PARIS AGREEMENT NDCS AND THE CALIFORNIA SCOPING PLAN

In 2015, developed country parties to the Paris Agreement submitted NDCs that committed to overall mass GHG reductions. The United States, for example, committed to reduce economy wide GHG emissions by 26-28% relative to 2005 levels by 2025.³² Canada initially committed to reduce national GHG emissions by 30% below 2005 levels by 2030. The EU submitted an NDC covering all of its 28 national members that commits to reducing GHG emissions on a group-wide basis to 40% below 1990 levels by 2030.

Most developing country parties plan to continue to increase mass GHG emissions as their economies mature, and submitted NDCs that committed to eventually reducing the GHG “intensity” of their economies by reducing the ratio of GHG emissions per gross domestic product (GDP). China’s primary NDC commitment is to reduce its CO₂ emissions intensity per unit of GDP by 60–65% relative to 2005 levels by 2030. India conditionally committed to reduce its GHG emissions intensity per unit of GDP by 33–35% relative to 2005 levels by 2020.³³ As discussed below, these NDCs would result in significant GHG emission increases over time.

The precise amount of GHG emissions covered by each NDC commitment depends on several factors, such as the level of emissions in and reduction from a party’s reference year, if applicable. In the case of China and India, future emissions also depend on assumptions about each nation’s GDP growth (and corresponding GHG emissions increases) to the applicable NDC target year. In December 2016, the World Resources Institute (WRI) published detailed estimates of the actual

amount of emission reductions (or increases) that the NDCs submitted by 15 of the world’s largest GHG emitters would achieve relative to each party’s most current emissions estimates. For example, if a country committed to a 20% reduction from 2005 levels by 2030, the study computes the difference from the reference year—2005—and the most current emissions report for the applicable nation. If the country’s emissions fell by 10% between 2005 and the most current year, the study computes the reduction required to achieve the 2030 goal from current levels. Since the Paris Agreement NDCs were made by each party in 2015, each nation’s emissions levels at that time, and not an earlier reference year, if applicable, provides the most relevant measure of the actual magnitude of the actions described in an NDC. Figure 1.1 summarizes the reduction commitments made by Argentina, Australia, Brazil, Canada, China, the EU, India, Indonesia, Japan, Mexico, Russia, South Africa, the Republic of Korea, Turkey, and the United States relative to the most recent national emissions inventories estimated by the World Resources Institute in late 2016. Figure 1.1 also shows California’s required reduction from 2015 emission levels, the latest published by CARB.

Figure 1.1 shows that California has committed to much more aggressive GHG reductions than any party to the Paris Agreement. Of the world’s largest GHG emission nations, mass GHG emissions from developing country Parties such as China, Russia, India and Turkey, will increase significantly by 2030 under the Paris Agreement, subject to ranges based uncertainty concerning actual GDP growth and other development that may occur over the next 15 years. None of the developed country Parties have committed to 2030 GHG reductions from current levels that are

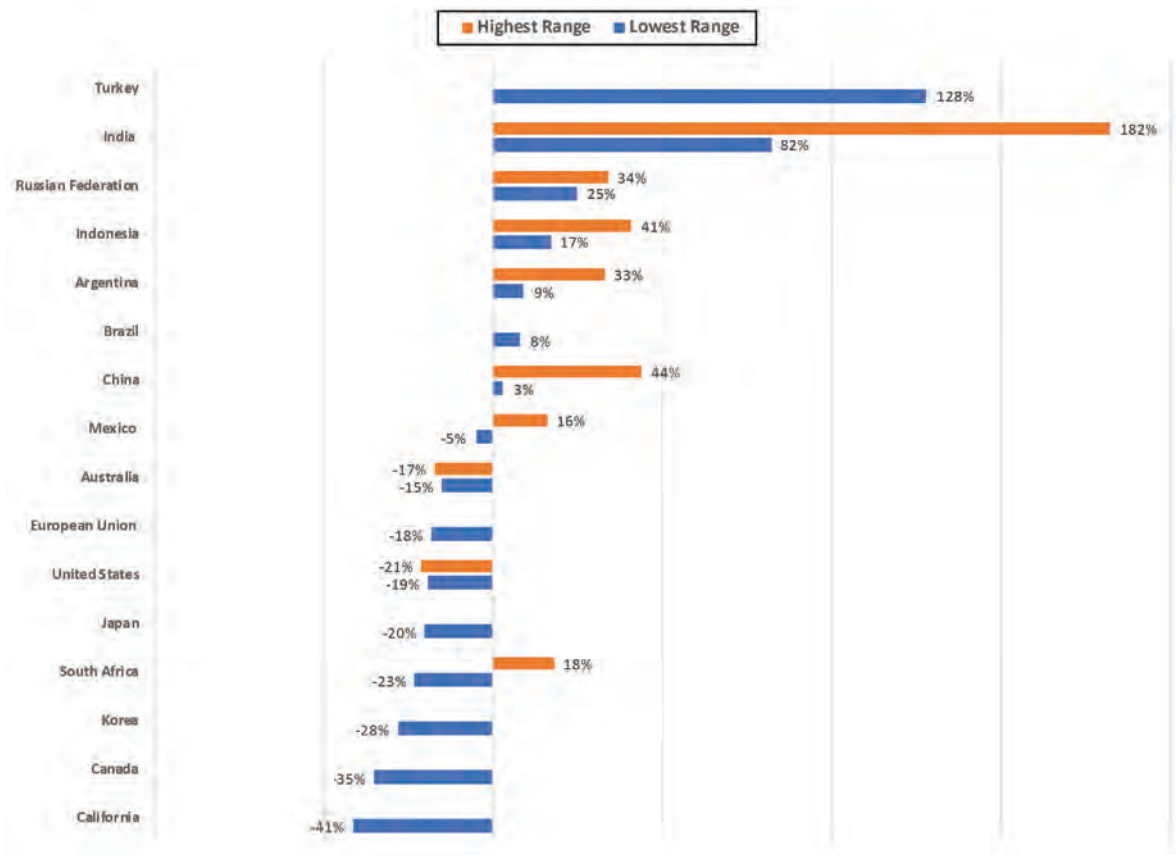
consistent with California’s plan to reduce GHG emissions by 41% from 2015 levels by 2030. No country has pledged to reduce emissions,

including the EU, by more than 40%. The California Scoping Plan includes both the legislated 2030 GHG reduction target, as well as an unlegislated target based on a gubernatorial

Figure 1.1

REQUIRED GHG EMISSIONS CHANGES (percent) from Most Recent Reported Emissions Levels to Meet Paris Agreement Commitments in 2030 by Country or Region

NOTE: Positive percentages correspond with increased GHG emissions and negative percentages correspond with reduced GHG emissions.



Sources: K. K. Ross et al., Translating Targets Into Numbers: Quantifying the Greenhouse Gas Targets Of The G20 Countries, World Resources Institute Working Paper (December 2016), Figure 21, https://www.wri.org/sites/default/files/Translating_Targets_into_Numbers.pdf, and California Air Resources Board, 2017 Edition California Greenhouse Gas Inventory for 2000-2015, <https://www.arb.ca.gov/cc/inventory/data/data.htm>, June 2017, accessed February 2018. In some instances, the NDCs include a range of potential commitments; the high and low end of the range as calculated by WRI is shown where applicable. Commitments for time frames prior to 2030 are assumed to extend to 2030 in the absence of an NDC commitment through 2030.

executive order to reduce GHG emissions within the California 80% below 1990 levels by 2050. No party to the Paris Agreement has submitted an NDC extending to 2050. As a result, Figure 1.1 does not include the 2050 California GHG emissions goal, although measures to achieve this unlegislated target are included in the approved Scoping Plan.

Only Canada would be required to reduce emissions by more than 30%, a commitment that first included GHG reductions from the land use, land use change and forestry (LULUCF) sector. LULUCF activities include urban and agricultural land uses, and forestry management practices, which can either increase GHG emissions or capture and sequester GHG emissions.³⁴ In 2017, however, Canada submitted a revised NDC that excludes the LULUCF sector, thereby removing land use changes and forestry management practices from the country's Paris Agreement commitment. Based on this revised approach, Climatetracker.org, has calculated that Canada's revised NDC translates to a 21% reduction below 2005 levels rather than a 30% reduction under the prior NDC, and just 5% below 1990 levels. Canada's most current emissions report shows that 2015 GHG emissions were about 722 MMTCO₂e, 2% below the 2005 level of 738 MMTCO₂e.³⁵ Consequently, assuming the analysis of Canada's revised NDC is accurate, the country's Paris Agreement reduction requirement from current levels would be less than half of California's 2030 legislated GHG reduction target. Although Canadian Prime Minister Justin Trudeau is an avid proponent of the Paris Agreement, the published analysis also indicates that Canada will likely fail to meet even its revised, and much less ambitious, NDC target.³⁶

In 2016, the UNFCCC published the most recent aggregate effect report of the

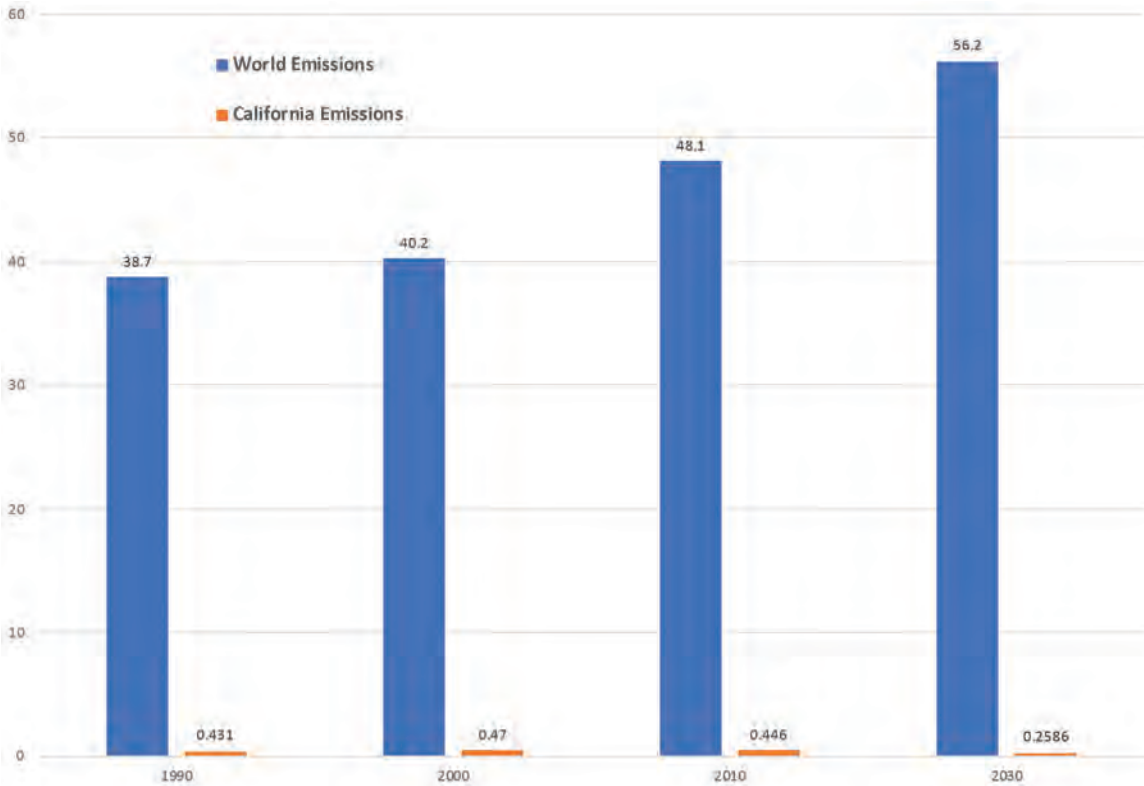
Paris Agreement NDCs on global emissions. As shown in Figure 1.2, the analysis projects that, assuming all NDC targets are met, the mean value of estimated 2030 global GHG emissions will be about 56,200 MMTCO₂e, 44% above 1990 levels, 38% above 2000 levels, and 16% above 2010 levels.³⁷ California's current inventory of GHG emissions is less than 1% of global anthropogenic GHG emissions. Figure 1.2 also shows that a disproportionately large GHG reduction in California would have an imperceptible statistical impact on global emissions in 2030. If the state reduces emissions by 41%, or 182 MMTCO₂e, from 2015 levels, it could potentially lower the UNFCCC's estimate of global emissions in 2030 by 0.32%. If California ceased to exist in 2030, global GHG emissions would be still be 99.54% of the Paris Agreement total. Neither of these California outcomes would meaningfully change the global temperature outlook for 2100.

C. THE EU PARIS AGREEMENT COMMITMENT AND THE SCOPING PLAN

Although the EU's Paris Agreement NDC for 2030 uses the same GHG commitment as California's legislated Scoping Plan reduction—an emissions reduction of 40% below 1990 levels—the EU actually is committed to achieve less than half the magnitude of California's cutbacks from 2015. As shown in Figure 1.3, the EU had already reduced emissions by 50% from its selected 1990 baseline by 2015 when the Paris Agreement became effective. About one-third of the EU's reduction occurred prior to 2000, and was almost entirely attributable to the shutdown of obsolete power plants, manufac-

Figure 1.2

GLOBAL EMISSIONS AND CALIFORNIA EMISSIONS, MMTCO₂E 1990, 2000, 2010 AND 2030



Sources: UNFCCC, Aggregate effect of the intended nationally determined contributions: an update, May 2016, pages 43-44, http://unfccc.int/focus/indc_portal/items/9240.php, and California Air Resources Board, 2017 Edition California Greenhouse Gas Inventory for 2000-2015, <https://www.arb.ca.gov/cc/inventory/data/data.htm>, June 2017, accessed February 2018.

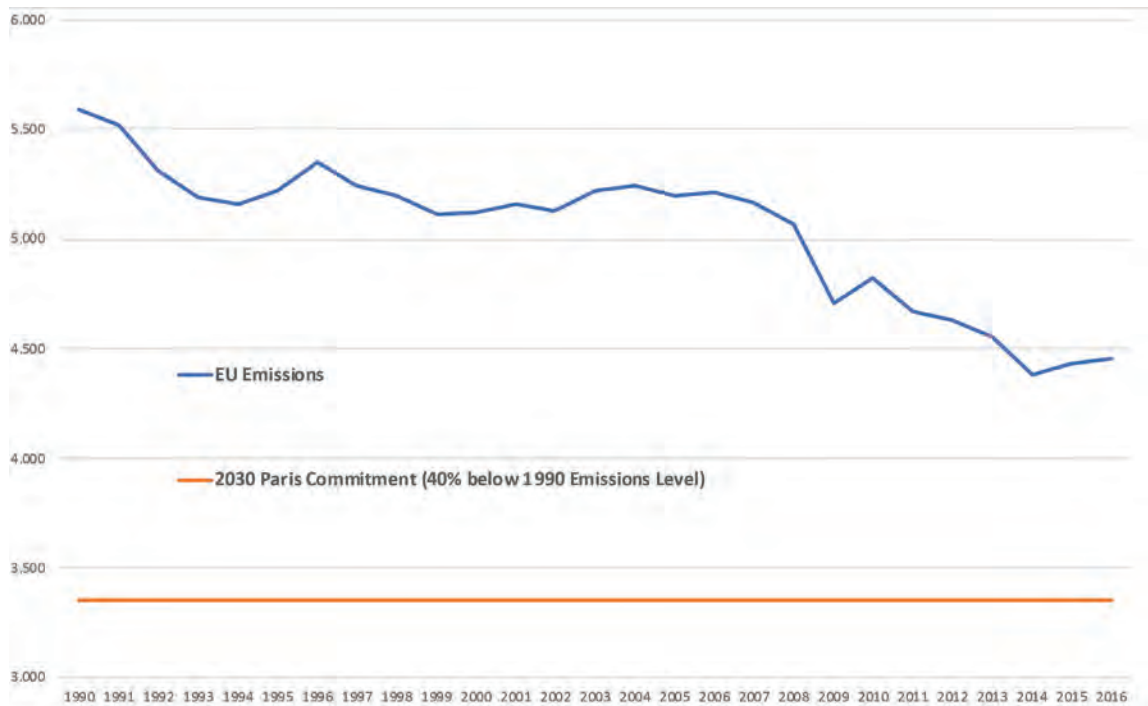
turing and other facilities in EU member states that were part of the former Soviet Union prior to 1990. On a national scale within the EU, the reunification of east and west Germany after 1990 similarly led to substantial GHG emission reductions from the closure and incorporation of inefficient east German power generation and industrial facilities with the cleaner and more efficient facilities post-unification.

Table 1.1 summarizes the net annual GHG emissions change and percentage for each EU

member state from 1990 to 2015. The results for each EU member state varied substantially. EU annual GHG emissions fell by 1,265 MMTCO₂e, a decline of 22%. Two countries, Germany and the United Kingdom, accounted 602 MMTCO₂e, or nearly 50% of the total EU GHG emission reductions although they comprised only 29% (146.8 million) of the total EU population (509.4 million) in 2015.³⁸ Romania, which had just 3.8% (19.8 million) of the total EU population in 2015 accounted for 10.2% of

Figure 1.3

EU HISTORICAL GHG EMISSIONS 1990–2016, 1990 EMISSIONS, AND 2030 EMISSIONS TARGET (MMT_{CO₂E})



Sources: Derived from PBL Netherlands Environmental Assessment Agency, Trends in global CO₂ and total greenhouse gas emissions: 2017 report, December 2017, <http://www.pbl.nl/en/publications/trends-in-global-co2-and-total-greenhouse-gas-emissions-2017-report>, accessed February 2018.³⁹

the total EU emission reductions. At the other extreme, GHG emissions increased by over 77 MMT_{CO₂E} from 1990 in Austria, Cyprus, Ireland, Portugal and Spain. In 2015, Spain, had the largest net annual GHG emissions increase in the EU. This is particularly notable given the country's efforts to expand solar energy, including subsidies of over \$8 billion euros per year in 2012 alone. Household energy costs increased by a reported 60% from 2006-2012, and political support for solar technology substantially fell, leading to a "sun tax" on solar energy and cutbacks of many solar subsidy programs in the country.⁴⁰

Table 1.2 summarizes EU and member state GHG emissions changes for 1990-2000, when nearly half of the current members were not part of the union, and for 2000-2015 after all but one EU member (Croatia in 2013) had been admitted. About one third of the total EU emissions reduction from 1990 occurred during 1990-2000, mainly due to German reunification and the closure of inefficient energy and industrial facilities in member states that were part of the former Soviet Union. During this period, GHG emissions rose by 220 MMT_{CO₂E} in other portions of the EU. Table 1.2 shows that the EU's actual GHG emission reduction

Table 1.1
NET CHANGE AND PERCENT CHANGE
IN GHG EMISSIONS, EU AND
MEMBER STATES, 1990–2015

	Net Change (MMTCO ₂ e)	Percent Change
EU	-1,265	-22%
Germany	-337	-27%
United Kingdom	-272	-34%
Romania	-129	-52%
Italy	-81	-16%
France	-81	-15%
Poland	-81	-17%
Czech Republic	-70	-35%
Bulgaria	-42	-41%
Slovakia	-33	-44%
Hungary	-33	-35%
Lithuania	-28	-58%
Belgium	-27	-18%
Estonia	-22	-55%
Denmark	-21	-29%
Netherlands	-19	-9%
Sweden	-17	-23%
Finland	-15	-20%
Latvia	-15	-56%
Croatia	-8	-25%
Greece	-7	-7%
Slovenia	-2	-9%
Luxembourg	-1	-11%
Malta	-0.02	-1%
Austria	1	2%
Cyprus	3	44%
Ireland	5	9%
Portugal	11	18%
Spain	57	19%

Source: compiled from Eurostat, 2017-GHG_statistics_tables_and_figures
 -update [http://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:2017-GHG_statistics_tables_and_figures-update.xlsx](http://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:2017-GHG_statistics_tables_and_figures-update.xlsx&oldid=340911)
 &oldid=340911, accessed February 2018

obligation from current levels would be much more substantial but for the enormous GHG reductions the EU inherited from the breakup of the Soviet Union during 1990-2000.

Unlike the EU, California did not inherit a massive GHG reduction from the shutdown of obsolete industrial facilities in the former

Soviet Union decades before setting its GHG emissions goals. Consequently, the state must unilaterally achieve much more significant GHG reductions from 2015 levels than EU was willing to make under the Paris Agreement. The state's disproportionately large reductions also ignore the fact that California experienced far more substantial population growth than the EU. As shown in Figure 1.4, since 1990 the EU population expanded by only 7.6%, while California grew by nearly 33%. More rapidly

Table 1.2
NET CHANGE IN GHG EMISSIONS,
EU AND MEMBER STATES, 1990–2015
(MMTCO₂E)

	1990-2015	1990-2000	2000-2015
EU	-1,265	-446	-819
Germany	-337	-201	-136
UK	-272	-69	-203
Former Soviet Union Member States	-463	-395	-67
Other Member States	-193	220	-413

Source: see Table 1.1

growing populations require more housing, more employment, more vehicular transport, more electricity, and more goods and services, which increases mass GHG emissions. Yet, the Scoping Plan requires more than double the mass GHG emissions reduction from 2015 to 2030 than the much slower growing EU has committed to achieve under the Paris Agreement.

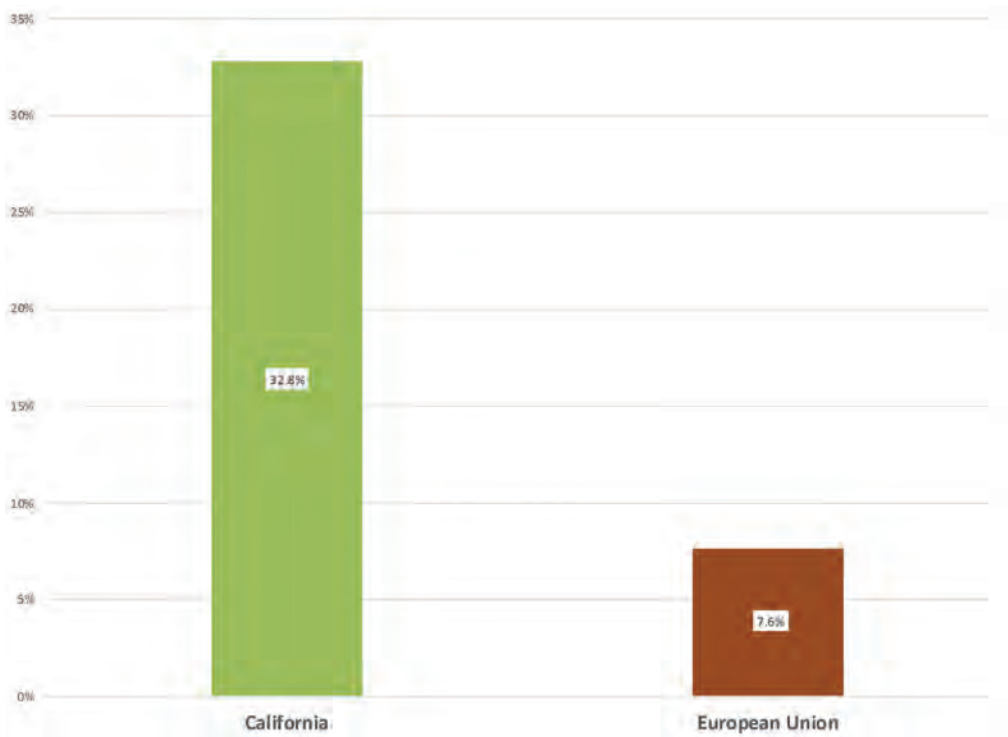
Figure 1.5 compares the EU and California per capita GHG emission declines in the energy production, residential and commercial, manufacturing and construction, and transport (on-road and non-commercial aviation) sectors from 2000 to 2015. The results show that notwithstanding California's significantly larger population gain, the state reduced emissions from all of these sectors, except manufacturing and construction, to a greater extent than the EU. Most notably, the EU did not substantially

reduce transport per capita emissions despite its slow growth and generally more compact urban areas. In contrast, California reduced per capita transport emissions by 19%. Since 2000,

shown in Figure 1.5. There is no rational basis for interpreting the Paris Agreement to require that California, an already highly-regulated state with a growing population, and not in

Figure 1.4

PERCENT CHANGE IN RESIDENT POPULATION CALIFORNIA AND EUROPEAN UNION 1990–2017



Sources: California Department of Finance, Table E-7, California Population Estimates, with Components of Change and Crude Rates, July 1, 1900-2017, <http://dof.ca.gov/Forecasting/Demographics/Estimates/E-7/>, December 2017 and Eurostat, Population change - Demographic balance and crude rates at national level, http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_gind&lang=en, accessed February 2018.

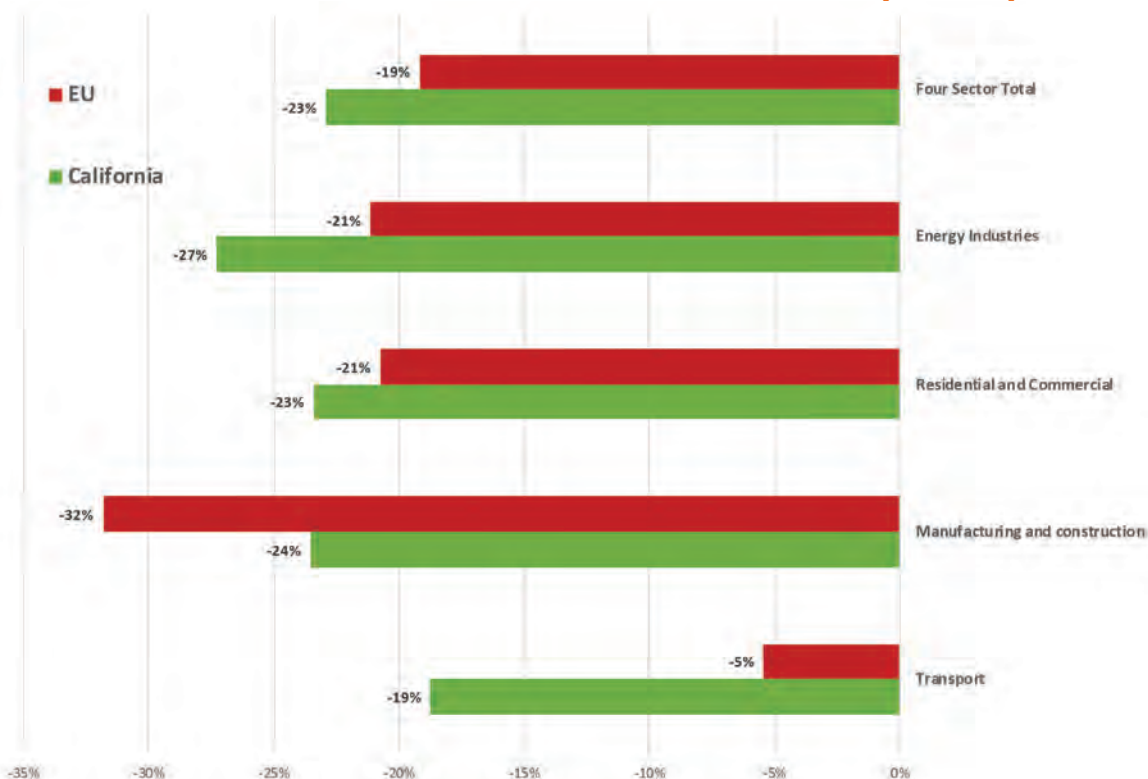
even though California’s driving population grew much more rapidly, the state’s overall transportation section emissions fell by 6.6% compared with just 1.3% in the EU.

In summary, the state achieved a greater level of per capita GHG reductions than the EU in the largest GHG emission sectors as

fact a party to the Paris Agreement, has a “fair share” obligation under the Paris Agreement to achieve more than twice the GHG reductions from 2015 levels than the EU is willing to make.

Figure 1.5

PER CAPITA GHG EMISSIONS REDUCTIONS IN THE ENERGY PRODUCTION, RESIDENTIAL AND COMMERCIAL, MANUFACTURING AND CONSTRUCTION AND TRANSPORT SECTORS FOR THE EU AND CALIFORNIA 2000–2015 (PERCENT)



Sources: See Table 1.4 for population data for 2000 and 2015. Sector emissions for EU from European Environment Agency, EEA greenhouse gas data viewer, [http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewerGHG emissions by aggregated sector](http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewerGHG%20emissions%20by%20aggregated%20sector), June 2017, https://www.eea.europa.eu/data-and-maps/daviz/ghg-emissions-by-aggregated-sector-1#tab-chart_3 and European Environment Agency, EU's 2017 GHG inventory submission under the UNFCCC, EU-28 Common Reporting Format (CRF) tables, Table for 2015, and California Air Resources Board, 2017 Edition California Greenhouse Gas Inventory for 2000-2015, IPCC Categorization, June 2017, <https://www.arb.ca.gov/cc/inventory/data/data.htm>, accessed February 2018.

D. RENEWABLE ENERGY IN LARGE EU MEMBER STATES AND THE SCOPING PLAN

Compared with other EU member states, California is proposed to achieve disproportionately large GHG emission reductions, including the CARB Scoping Plan’s

administrative (and not legislatively authorized) 80% reduction mandate by 2050, with far fewer “clean” non-GHG emitting electric generation options. As shown in Table 1.3, the EU as a whole, as well as the EU’s top three electrical generating nations (Germany, the U.K. and France), all have a much more heterogeneous set of energy resources to manage future emissions than California.

Europe is largely self-sufficient in electrical production, but California imports nearly one-third of its electricity supply, far more than any major country in Europe or any other state in the U.S. Nuclear energy, which has no GHG emissions, accounts for 25% of all EU electrical power and 79% of the electric supply for France. In 2017, California decided to close its last remaining nuclear power plant by 2025, and will lose the remaining 7% of its in-state

GHG emissions in the U.K. fell by 34% since 1990, and 27% since 2000.

A significant component of the reduction in the U.K. is attributable to the so-called “dash for gas” policies initially implemented under Prime Minister Margaret Thatcher, one of the first major political figures to express concerns about global warming, in part to undermine coal miner unions,⁴¹ but also as a result of the government’s energy market liberalization

Table 1.3

ELECTRICAL POWER FUEL SOURCES, PERCENT OF TOTAL TERAWATT HOURS PER YEAR, EU 2017, CALIFORNIA 2016

	Lignite, Coal, Other Fossil Fuel	Natural Gas	Nuclear	Hydro	Wind, Solar Geothermal	Biomass	Imports	Total (TWh)
EU	25%	20%	25%	9%	15%	6%	1%	3,261
UK	9%	39%	20%	2%	17%	9%	4%	348
France	4%	7%	79%	9%	7%	1%	-8%	505
Germany	45%	15%	13%	3%	24%	9%	-8%	598
California	0.3%	34%	7%	10%	15%	2%	32%	291

Sources: California total from California Energy Commission, Total System Electric Generation, June 2017 (for 2016), http://www.energy.ca.gov/almanac/electricity_data/total_system_power.html; EU totals from Sandbag/Agora, The European Power Sector in 2017, data annex, <https://sandbag.org.uk/wp-content/uploads/2018/01/2000-2017-generation-data.xlsx>, accessed February 2018.

generation capacity from this source. Natural gas accounts for 34% of California’s in-state electrical production, compared with just 20% in the EU as a whole, but is about the same as in the U.K., which has been substituting cleaner-burning natural gas and biomass for coal-fired generation.

Table 1.4 shows that the UK has reduced mass GHG emissions more consistently in 1990-2015 and particularly during 2000-2015, than the EU overall, Germany, and other former Soviet Union and other EU member states.

during the 1990s. The development of the country’s North Sea hydrocarbon resources reduced natural gas prices, and newly privatized power generators in the U.K. steadily replaced older coal generation facilities with much more efficient combined cycled gas turbine (CCGT) plants. The typical CCGT plant produces half the GHG emissions from coal-fired generation. After 2000, as the U.K. and the rest of the EU began focusing on renewable power sources to address climate change, CCGT technology proved useful because it could be rapidly

ramped up to meet demand while supplies from more uncertain but cleaner power sources, such as solar and wind, fluctuate.⁴² As shown in Table 1.3, in 2017 the U.K. relied on natural gas for 39% of its power generation, significantly higher than the 20% production level in the EU overall, and higher than California in 2016 (34%).

In more recent years, GHG emission reductions in the U.K. and in other parts of the EU also resulted from the growing use of “biomass” – primarily wood products such as pellets - to generate electricity and heat. Many countries, including the U.K., are subsidizing the use of wood products such as pellets in utility-scale power plants to meet renewable power goals. Under the EU rules, the CO₂e emissions from wood burned in these facilities are not counted as GHG emissions, nor is power generation using biomass required to buy allowances under the EU Emissions Trading System, the world’s first cap and trade market for GHG emissions.

The rationale for the EU approach is that sources of biomass, largely derived from harvesting forests to create pellets and similar wood products, will eventually grow back and “recapture” in new trees the GHG emissions generated when the wood products were burned.⁴³ According to the European Environment Agency (EEA), emissions from biomass in the EU have risen by about 250% since 1990, to more than 534 MMTCO₂e per year in 2015, about 21% more than California’s total GHG emissions (440 MMTCO₂e) reported by CARB for 2015 (see Figure 1.6). If biomass GHG emissions were included in the GHG emission inventory, the EU’s total GHG emissions would be about 12% higher in 2015 than reported levels, substantially reducing the EU’s achievement of its Paris Agreement commitments and further highlighting the

Table 1.4

EU, U.K., GERMANY, FORMER SOVIET UNION MEMBER STATE AND OTHER MEMBER STATE TOTAL MASS GHG EMISSIONS REDUCTIONS 1990–2015 AND 2000–2015

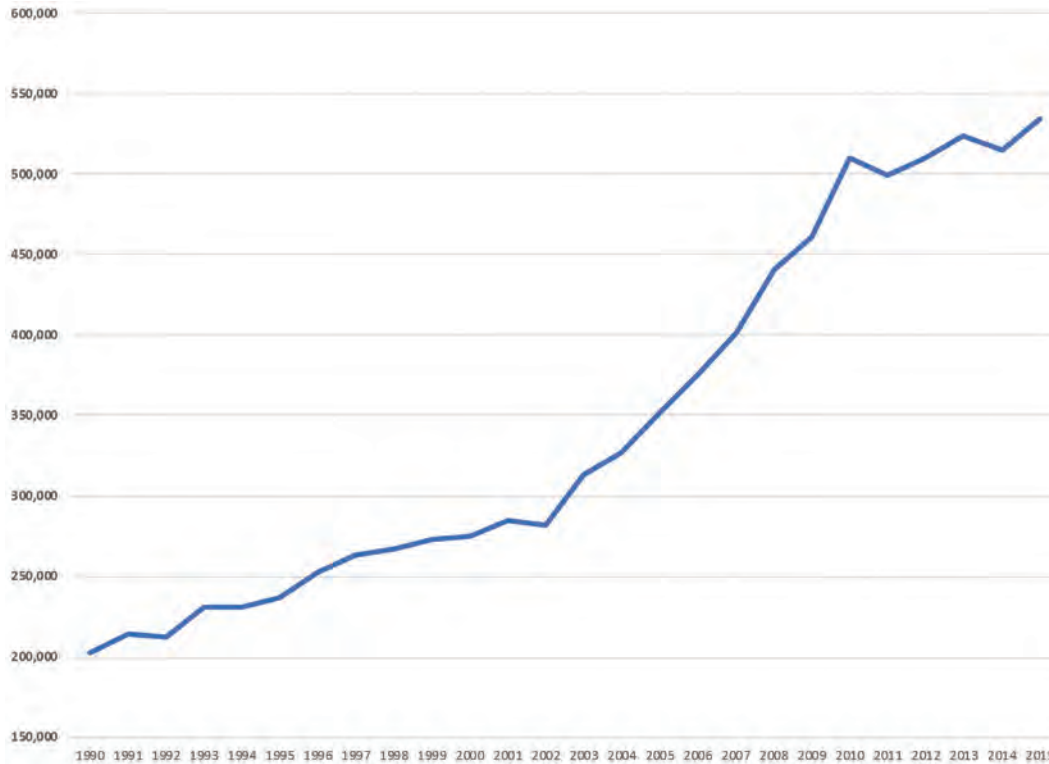
	1990-2015	2000-2015
EU	-22%	-16%
Germany	-27%	-13%
UK	-34%	-27%
Former Soviet Union Members	-34%	-7%
Other Members	-8%	-16%

significant progress in California’s GHG reductions notwithstanding the state’s much more rapid population growth.

European biomass consumption has stimulated investments in live forest harvesting and processing facilities in the southeastern U.S., and to a lesser extent in Canada, Southern Africa and in eastern Europe, all of which are now exporting wood pellets for EU power production. An International Energy Agency study estimates 6.3 million tons of pellets were exported from the U.S. and 2.4 million tons from Canada to the EU in 2015. Imported pellets from these and other sources were mainly used in the U.K. (6.7 million tons), Denmark (2.8 million tons) and Italy (2.1 million tons).⁴⁴ Many scientists and environmental advocates oppose obtaining wood pellets from existing forests because the GHG emissions from burning wood products can be significantly higher than using coal, generally regarded as the most carbon-intensive source of utility scale power generation. The emissions are later recovered, if at all, only after several decades of natural forest regrowth. Replanting southern hardwood forests with

Figure 1.6

PERCENT CHANGE IN RESIDENT POPULATION CALIFORNIA AND EUROPEAN UNION 1990–2017



Source: European Environment Agency, EEA greenhouse gas data viewer, [http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewerGHG emissions by aggregated sector](http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewerGHG%20emissions%20by%20aggregated%20sector), June 2017, https://www.eea.europa.eu/data-and-maps/daviz/ghg-emissions-by-aggregated-sector-1#tab-chart_3, accessed February 2018. Biomass emissions are labeled in the EEA summary as “CO2 biomass” and are considered by the EU as a “memorandum item” not included in total reported emissions.

faster-growing trees for commercial harvesting, for example, will not net out, even in the long run, the emissions from pellet use in earlier periods. In addition to impacts on existing forests and wildlife habitats, wood pellet use in the EU generates significant, but officially uncounted GHG emissions and increase the likelihood of exceeding the Paris Agreement 2100 temperature limit decades before future forest regrowth could possibly recapture the emissions.⁴⁵

Unlike the EU, California legislators and regulators have taken a far more hostile approach to biomass conversion technologies generally, and the use of forestry products as a fuel for electric power generation. About 33% of California’s one hundred million acres of land are forested,⁴⁶ but timber harvesting activities in the state dropped by approximately two-thirds (from approximately 4,500 million board feet in 1978 to about 1,500 million board feet in 2016), with the most dramatic drop beginning in 1990 due primarily to environmental

species and water quality advocacy efforts.⁴⁷ Environmentalists also induced the state legislature to ban renewable energy subsidies for biomass facilities that result in any air emissions, whether harmful or not, including greenhouse gases.⁴⁸ As a result, the California Energy Commission (CEC) has been forced to disqualify almost all new biomass energy production technologies.⁴⁹ Although biomass remains, at least technically, a renewable energy resource for purposes of meeting California's renewable portfolio standard, as of 2016 biomass facilities produced less than 6 percent of California's in-state generated electricity. California's GHG reduction achievements in the electric power sector are all the more remarkable given that, unlike the EU, the state is much less willing to develop biomass renewable technologies and is closing all in-state nuclear power plants.

EU climate rules do not recognize any GHG emissions from the harvesting, processing, transportation or combustion of wood pellets from live and often cleared South Carolina and South African forests to burn in U.K. or other EU power plants. In contrast, California's legal framework has made renewable energy biomass conversion technology almost impossible. As discussed in Section 2 of this report, given the extreme wildfire risks and significantly enhanced GHG emissions caused by millions of dead or dying trees in California's poorly managed forests, as well as readily-available biomass from agricultural and municipal solid wastes, renewed efforts have been made to allow California to diversify its renewable energy portfolio with more biomass facilities. Political opposition to these technologies, however, remains strong. California's GHG reduction achievements in the electric power sector are all the more remarkable, in relation to the EU, given the EU's generous support of what it deems zero-GHG emission biomass technologies, as well as its substantial use of nuclear power production.

E. THE END OF CLIMATE POLICY UNILATERALISM IN EUROPE?

Just as the Paris Agreement was being finalized, EU emissions, and emissions in several influential EU member states such as France and Germany, began to rise. As shown in Table 1.5, during 2014-2016 annual EU GHG emissions increased by about 2% to 70 MMTCO₂e, and rose by over 1% in Germany and over 4% in France. In contrast global emissions rose by less than half the EU rate while emissions fell by 220 MMTCO₂e in the United States, 100 MMTCO₂e in China, and 40 MMTCO₂e in Japan. World GHG emissions, including from the EU, China, India and Indonesia, also rose during 2017 but continued to fall in the United States.⁵⁰

The EU's recent emission increases are related to several factors, including growing opposition to higher energy costs and employment impacts related to European climate change policies. In Germany, for example, after unexpectedly strong support for nontraditional parties in the last national election, chancellor Angela Merkel was only able to form a coalition government months after effectively abandoning the country's unilateral GHG emission targets and refusing to set a "coal exit" date as demanded by the Green party and other environmental advocates.⁵¹ Responding to widespread political discontent with Germany's disproportionately large climate policy commitments, political leaders close to Merkel announced that "nation-specific (unilateral) targets for climate protection are counterproductive and should therefore be abandoned."⁵²

Germany has also struggled to efficiently use its new additional wind and solar capacity, which often produces power at times when demand is below supply and has a negative value—e.g., "negawatt" power production. Due to local and regional political opposition, the German government has been unable to

Table 1.5

NET AND PERCENT GHG EMISSIONS CHANGE FOR SELECTED COUNTRIES AND THE WORLD 2014–2016

	MMTCO2e	Percent Change
EU	70	1.6%
France	20	4.3%
Germany	10	1.1%
Italy	20	4.8%
Netherlands	8	4.1%
Poland	14	3.7%
Spain	12	3.7%
United Kingdom	-40	-7.8%
China	-100	-0.8%
United States	-220	-3.3%
India	230	6.7%
Japan	-40	-2.8%
World	350	0.7%

Source: Derived from PBL Netherlands Environmental Assessment Agency, Trends in global CO2 and total greenhouse gas emissions: 2017 report, December 2017, <http://www.pbl.nl/en/publications/trends-in-global-co2-and-total-greenhouse-gas-emissions-2017-report>, accessed February 2018.

build new powerlines to more efficiently move wind power from the north to the south of the country or dump excess renewable power in adjacent Poland and the Czech Republic.⁵³ After a reactor was damaged during a 2013 earthquake in Japan, Germany decided to close its remaining nuclear power plants for safety

reasons. As a result, and despite its reputation as a global climate leader, the country continues to stabilize its domestic power grid by using lignite (compressed peat) power plants, the dirtiest source of electrical energy in Europe.⁵⁴ Germany’s decision to renounce its national climate change goals, refusal to close coal and lignite plants, and rising GHG emissions have challenged Merkel’s legacy as the “Climate Chancellor” of Europe.⁵⁵

French GHG emissions rose even faster than in Germany since 2014. In December 2017, President Emmanuel Macron defended France’s use of nuclear energy against environmental critics and chastised Germany for closing “all their nuclear in one go” and increasing its “CO₂ footprint.”⁵⁶ Scarcely a month later, the French environment agency reported that, despite the availability of nuclear power for over 70% of the nation’s energy supply, the country’s GHG emissions increased due to greater fossil fuel use. France also failed to meet its national emissions goals, and promised to revise its GHG reduction goals later in 2018.⁵⁷ “France” said environment minister Nicolas Hulot after announcing the bad news, “can’t be looking down” on any other countries.⁵⁸

These domestic developments parallel changes in the EU emissions reduction program that also deemphasize national targets and focus on collective goals and “energy governance.”⁵⁹ In January 2018, the European Parliament voted for a 35% renewable energy target but again without specific member state obligations. The Parliament instead proposed that each state submit “national energy and climate action plans” stating how they intend to contribute to the collective European target by June 1, 2019.⁶⁰

At present, the EU, and key EU member states including Germany and France, have shifted the focus of climate policy from unilateral, national targets to collective and international objectives. Part of this change can be explained by the growing realization that unilateral targets are increasingly unlikely to have any measurable effect on global GHG emissions, but harm domestic constituencies increasingly willing to vote for non-mainstream parties that oppose climate change policies. Since 2007, when both the EU (and California) began to implement more stringent emissions control policies, almost all of the world's GHG emission reductions have occurred in the U.S. and the EU. Emissions from the rest of the world, including locations from which the EU and U.S. import products they no longer make domestically, swamped the magnitude of these reductions. As shown in Table 1.6, between 2007-2016 the EU and the U.S. combined to reduce annual GHG emissions by about 1,240 MMTCO_{2e}, a 10% decline. Emissions from the rest of the world, even counting relatively modest reductions in Russia and Japan, rose by over 6,500 MMTCO_{2e}, a 20% increase.

Given these trends, it is unsurprising that EU leaders would be increasingly reluctant to adopt costly “go it alone” policies, particularly when they result in higher energy prices and green regulations that threaten the competitiveness of politically influential and economically critical domestic industries such as manufacturing. The U.K., the one major EU country that is likely to meet the EU 2030 reduction target under the Paris Agreement, has done so based on its very generous determination that burning vast quantities of GHG-emitting biomass culled from existing forests in the U.S. and other locations results in no net GHG emissions over time.

Table 1.6

**GHG EMISSIONS CHANGE 2007–2016,
SELECTED COUNTRIES AND REGIONS**

	Net Change (MMTCo_{2e})	Percent Change
EU	-720	-14%
<i>United Kingdom</i>	-200	-30%
<i>France</i>	-40	-8%
<i>Germany</i>	-40	-4%
United States	-520	-7%
Russian Federation	-90	-4%
Japan	-50	-3%
India	1,210	50%
Rest of World	2,240	14%
China	3,240	33%
Total	5,300	12%
EU + U.S.	-1,240	-10%
Rest of World	6,540	21%

Source: Derived from PBL Netherlands Environmental Assessment Agency, Trends in global CO₂ and total greenhouse gas emissions: 2017 report, December 2017, <http://www.pbl.nl/en/publications/trends-in-global-co2-and-total-greenhouse-gas-emissions-2017-report>, accessed February 2018.

In contrast, the California Scoping Plan remains almost entirely focused on achieving unilateral, subnational legislated (40% by 2030) and unlegislated (80% by 2050) GHG emission reduction targets, with significant legal and practical constraints on the use of nuclear, biomass, and even larger hydropower projects. The following section discusses some of the potentially adverse consequences resulting from California's increasingly unilateral climate policy approach.

II. CALIFORNIA AND THE LIMITS OF UNILATERALISM

The Scoping Plan emphasizes that the state’s climate change policies reflect California’s “decades of leadership” in environmental protection. “California,” it states, “pushes old boundaries, encounters new ones, and figures out ways to break through those as well. ...California’s approach to climate change channels and continues this spirit of innovation, inclusion, and success.”⁶¹ Notwithstanding this assertion, since the Global Warming Solution Act was enacted in 2006, GHG emissions reductions in the rest of the United States have significantly exceeded the reductions achieved by California, including much larger cutbacks in states not typically perceived to be climate policy pioneers.

A. GHG EMISSIONS REDUCTIONS IN CALIFORNIA AND THE REST OF THE NATION

According to the most recent national GHG emission inventory completed by the

Table 2.1

GHG EMISSIONS CHANGE U.S., CALIFORNIA, AND U.S. EXCLUDING CALIFORNIA, 2007-2015

	2007	2015	Net Change (MMTCO ₂ e)	Percent Change
United States	7,349	6,587	-762	-10.37%
California	486	440	-46	-9.42%
US excluding California	6,863	6,146	-717	-10.44%

Sources: California Air Resources Board, 2017 Edition California Greenhouse Gas Inventory for 2000-2015, June 2017; United States Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2015 (April 2017) EPA 430-P-17-001, <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2015>, accessed February 2018.

U.S. Environmental Protection Agency and submitted to the UNFCCC (during former President Barack Obama’s tenure), from 2007-2015 the U.S. reduced annual GHG emissions by 762 MMTCO₂e or 10.4% percent.⁶² Over the same period, California emissions fell by 46 MMTCO₂e, just 6% of the total U.S. reduction. As shown in Table 2.1, GHG emissions fell to much greater extent and decreased more rapidly in the U.S. excluding California than in California alone.

California’s per capita energy use was lower than in the rest of the U.S. in 2007, and remained lower in 2015, due in part to the concentration of the state’s population in areas with a uniquely mild climate. About 40% of California households, for example, do not have or use air conditioning, and about 14% do not use space heating.⁶³ Nevertheless, as shown in Table 2.2, during 2007-2015, per capita GHG emissions in the rest of the U.S. were reduced by nearly 4 tons compared with just 2 tons in the state alone.

The data show that, despite California’s landmark climate change legislation and unequalled climate change regulatory requirements, during 2007-2015 the rest of the nation cut net annual GHG emissions more than 15.6 times the net reduction in the state (717 MMTCO₂e in the U.S. excluding California versus 46 MMTCO₂e in the state). The amount of the reductions achieved in the U.S. excluding California was more than 1.6 times the state’s entire GHG emission inventory (440.4 MMTCO₂e) reported by CARB for 2015. Excluding California, the rest of the U.S. cut GHG emissions by an amount equal to total California emissions in 2015 plus an additional reduction of 276 MMTCO₂e (about the same as the 278.7 MMTCO₂e emissions for the Netherlands and Portugal combined in 2015)⁶⁴ for good measure.

The U.S. Energy Information Agency (EIA) publishes estimates of total carbon dioxide

(CO₂) emissions for each state. These data are not directly comparable with California, national and international emissions accounting based on a combination of CO₂ and other GHG gases and reported as “carbon dioxide equivalent” (i.e., “CO₂e”) emissions. Carbon dioxide, however, accounts for more than 80% of total California and U.S. GHG emissions,⁶⁵ and the EIA data covers the substantial majority of total state GHG emissions. Figure 2.2 shows the net reduction in annual CO₂ emissions by state from 2007-2015.

The data shows that California accounted for just 5% of the total

Table 2.2

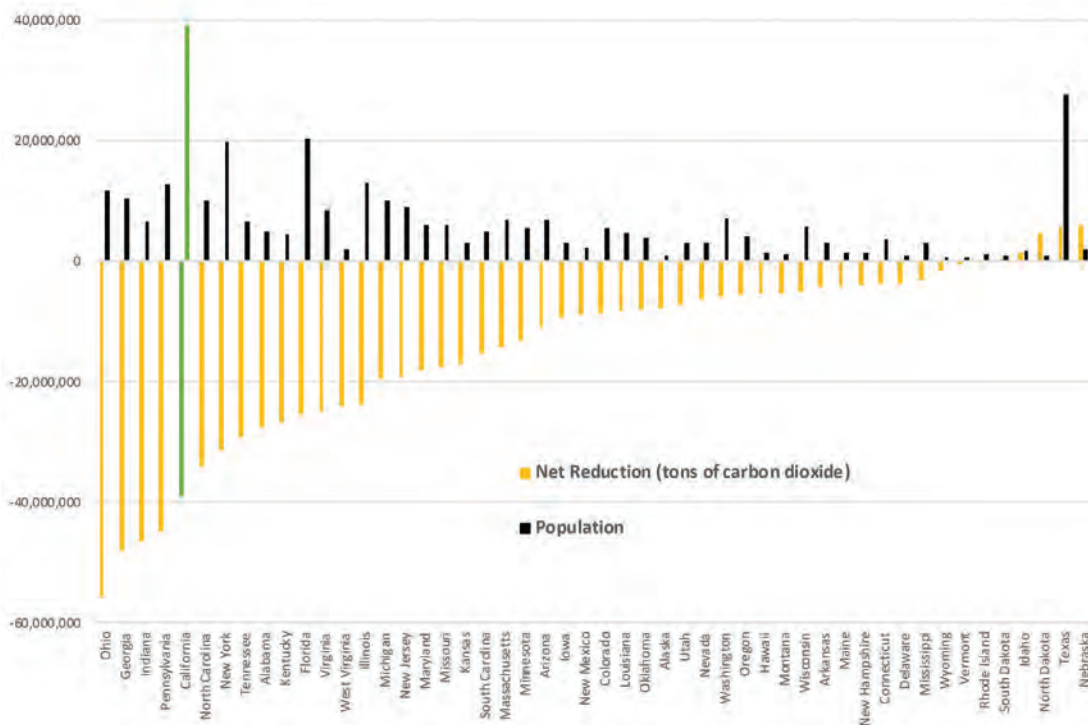
PER CAPITA GHG EMISSIONS CHANGE, 2007–2015 U.S., CALIFORNIA, AND U.S. EXCLUDING CALIFORNIA

	2007	2015	Net Change (tons CO ₂ e)
United States	24.4	20.7	-3.7
California	13.4	11.3	-2.0
US excluding California	25.9	22.0	-3.9

Sources: For emissions, see Table 9. Population data used to calculate per capita estimates from the U.S. Census Bureau, Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2017, <https://www.census.gov/data/datasets/2017/demo/popest/state-total.html>, accessed February 2018 for 2010-2015 and U.S. Census Bureau, Statistical Abstract of the United States: 2012, Population estimates, <https://www.census.gov/library/publications/2011/compendia/statab/131ed/population.html>, accessed February 2018 for annual state and national population data prior to the 2010 census benchmark.

Figure 2.1

TOTAL NET CHANGE IN CO₂ EMISSIONS BY STATE 2007–2015, POPULATION AND TONS OF CO₂



Source: U.S. Energy Information Agency, State Carbon Dioxide Emissions Data, October 2017, <https://www.eia.gov/environment/emissions/state/>, accessed February 2018. Population data from sources listed in for Table 2.2

Table 2.3

SUMMARY OF STATE AND NATIONAL GHG REDUCTIONS, 2007–2015

	Population in 2015	Net Reduction (MMTCO ₂)	Percent of National Reduction
US Total	321,039,839	-726	100%
California	39,032,444	-39	5%
Ohio, Georgia, Indiana, Pennsylvania	41,207,280	-195	27%
North Carolina, Tennessee, Alabama, Kentucky	25,905,410	-117	16%

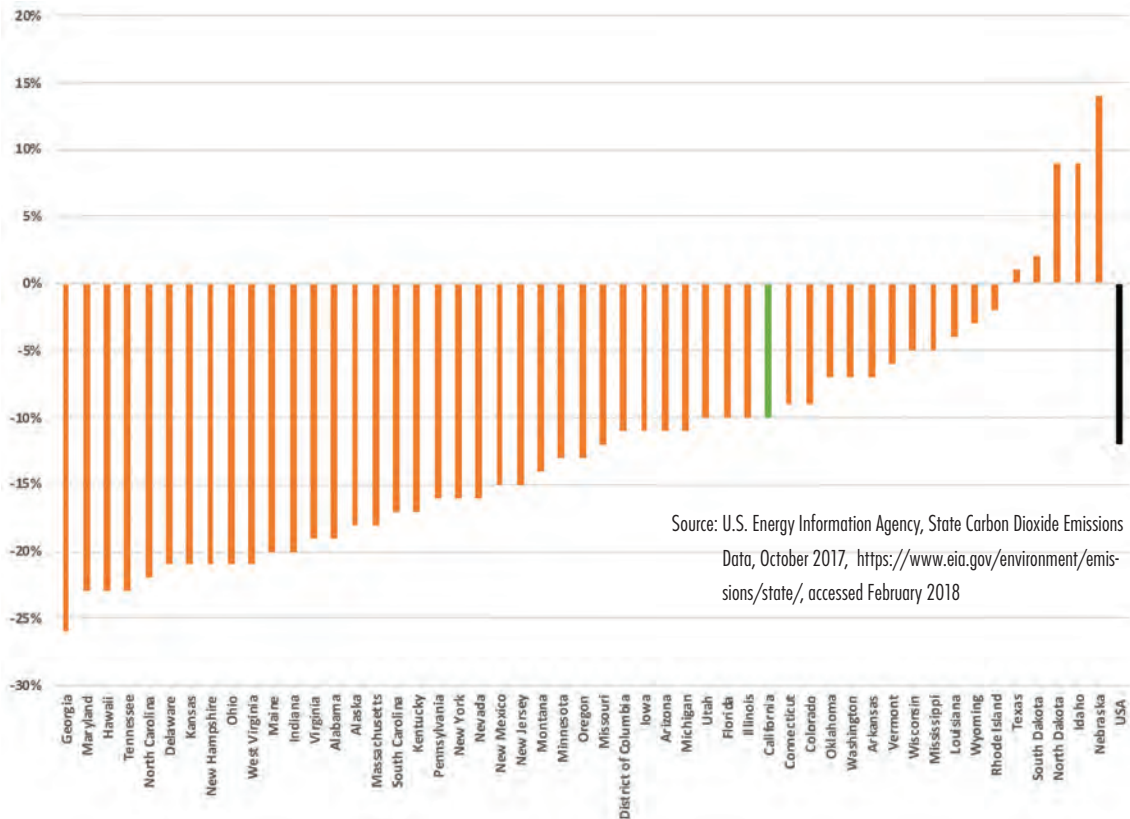
Source: U.S. Energy Information Agency, State Carbon Dioxide Emissions Data, October 2017, <https://www.eia.gov/environment/emissions/state/>, accessed February 2018; for population, see Table 2.2

net reduction of CO₂ emissions in the US from 2007-2015 (39 MMTCO₂ of a national reduction of 726 MMTCO₂). Four states, Ohio, Georgia, Indiana, Pennsylvania, none of which have even half the population of California, each reduced total mass CO₂ emissions by

more than California. Much smaller states, including Alabama, Kentucky, Tennessee and North Carolina, nearly matched the total GHG reductions achieved by California. Table 2.3 shows that Ohio, Georgia, Indiana, and Pennsylvania had about the same population

Figure 2.2

PERCENT CHANGE IN CO₂ EMISSIONS BY STATE AND U.S., 2007–2015



Source: U.S. Energy Information Agency, State Carbon Dioxide Emissions Data, October 2017, <https://www.eia.gov/environment/emissions/state/>, accessed February 2018

as California but reduced total mass CO₂ emissions by 195 MMTCO₂, five times more than in California, since 2007. Alabama, Kentucky, Tennessee and North Carolina collectively had just two-thirds the population of California in 2015 but reduced total mass CO₂ emissions by 117 MMTCO₂ since 2007, three times more than in California.

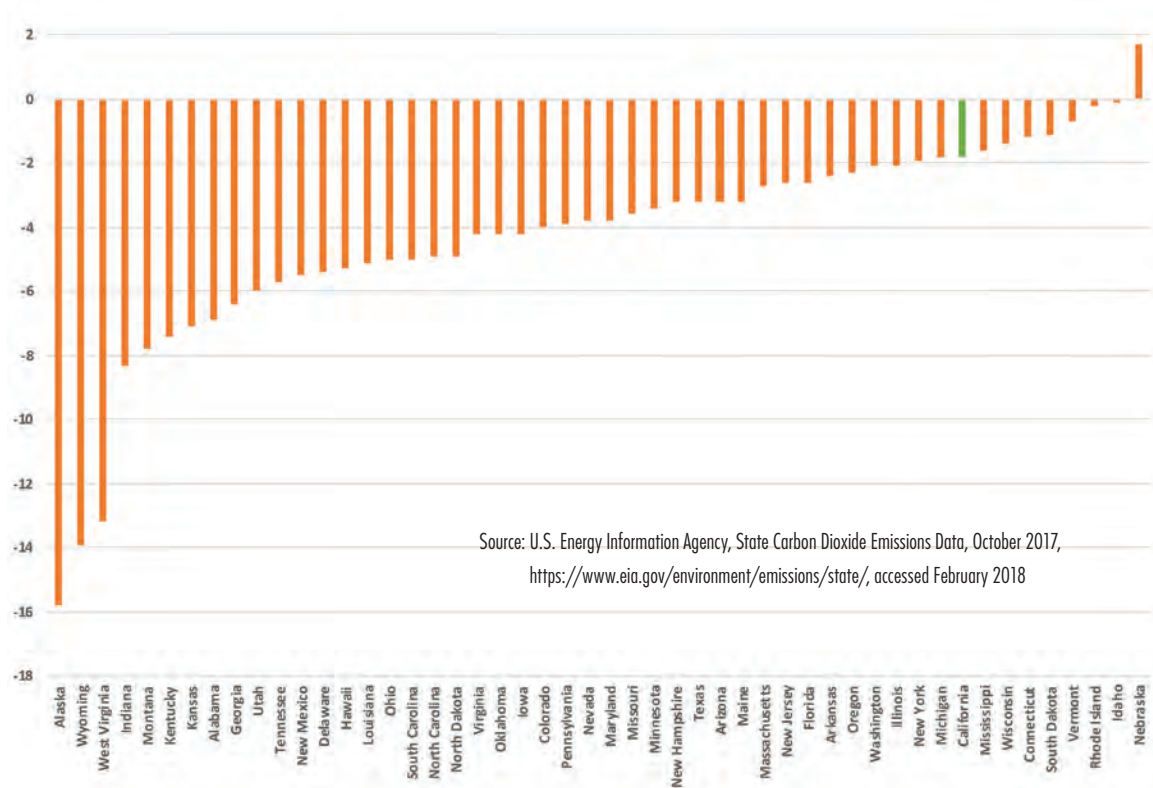
Figure 2.2 shows that, since the Global Warming Solutions Act became effective in 2007 the state has not cut total CO₂ emissions by the US average rate, let alone to the extent achieved in most other states. The US as a whole reduced CO₂ emissions by 12% compared

with 10% in California. Thirteen states reduced emissions by at least 20%, twice the rate in California. Overall, 33 states achieved a greater percentage decline in mass CO₂ emissions than California during 2007-2015.

Figure 2.3 shows that between 2007-2015 California reduced per capita CO₂ emissions by about 1.8 metric tons. A total of 41 states, however, achieved a higher level of per capita emission reductions, including 32 states that each reduced per capita emissions by more than 3 tons. Fifteen states reduced per capita CO₂ emissions by more than 5 tons.

Figure 2.3

PER CAPITA CHANGE IN CO₂ EMISSIONS BY STATE, 2007–2015, METRIC TONS OF CO₂



Source: U.S. Energy Information Agency, State Carbon Dioxide Emissions Data, October 2017, <https://www.eia.gov/environment/emissions/state/>, accessed February 2018

Table 2.4

SUMMARY OF CO₂ EMISSION REDUCTIONS IN CALIFORNIA AND OHIO, GEORGIA, INDIANA, AND PENNSYLVANIA, 2007–2015

	California	Ohio, Georgia, Indiana, Pennsylvania
Net Emissions Reduction 2007-2015 (MMTCO₂)	-39	-195
Per capita Emissions reduction 2007-2015 (tons of CO₂)	-1.70	-5.49

Source: U.S. Energy Information Agency, State Carbon Dioxide Emissions Data, October 2017, <https://www.eia.gov/environment/emissions/state/>, accessed February 2018

The reductions in the rest of the U.S. were all the more notable because they did not result in the largely regressive consumer energy price increases that occurred in California. For example, Ohio, Georgia, Indiana, Pennsylvania collectively have almost the same population as California (see Table 2.2). As shown in Table 2.4, however, total emissions in these four states fell by five times, and per capita emissions fell by three times the amount in California during 2007-2015.

Since the Global Warming Solutions Act became effective in 2007, energy prices in California due to the state’s cap and trade program, low carbon fuel mandates, energy taxes and falling in-state fossil fuel production increased substantially above the national average. As shown in Table 2.5, Ohio, Georgia, Indiana, and Pennsylvania collectively reduced emissions to a much greater extent than in

California while protecting consumers and maintaining energy prices at levels below or much closer to the national average. In 2016, average annual electricity costs were 58% higher and residential natural gas prices were 12% higher in California than in these four states. In February 2018, California consumers also paid about \$0.90 more per gallon of regular gasoline than in the four states, and about \$0.80 above the national average.

The U.S. reduction in GHG emissions, and the much more significant total and per capita reductions that occurred in many states outside of California, are due primarily to the substitution of cleaner-burning natural gas for coal in electrical and heat production facilities. A secondary factor was a more modest decrease in emissions from petroleum use, about half of which was attributable to the continued improvement in fuel economy and GHG

Table 2.5

CALIFORNIA, FOUR-STATE AND U.S. ENERGY PRICES 2016 (ELECTRICITY AND NATURAL GAS) AND FEB. 2018 (REGULAR GASOLINE)

	California	Four States	U.S. Average
Electricity Cost per KWh (2016 annual average)	\$15.23	\$9.62	\$10.27
Natural Gas Cost per Thousand Cubic Feet (2016 annual average, residential)	\$11.84	\$10.49	\$10.05
Regular Gasoline Cost per Gallon (February 21, 2018)	\$3.32	\$2.46	\$2.56

Sources: Average 2016 electricity prices from U.S. Energy Information Agency, Electric Power Annual, Table 2.10, December 2, 2017, <https://www.eia.gov/electricity/annual/>; average 2016 natural gas residential prices from U.S. Energy Information Agency, Natural Gas Prices, https://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_a.htm; regular gasoline prices from American Automobile Association, Gas Prices, <http://gasprices.aaa.com/state-gas-price-averages/>, accessed February 21, 2018. Four State totals are weighted averages based on the number of households in each state.

emissions per mile achieved by the nation's regulated fleet of gasoline and diesel fueled vehicles.

Table 2.6 summarizes U.S. CO₂ emissions by primary energy source from 2007 to 2016. Over this period, U.S. CO₂ emissions from the use of coal, natural gas and petroleum fell by 37%, a net decrease of 818 MMTCO₂. The decrease is larger than the 726 MMTCO₂ cutback shown for 2007-2015 in Table 2.3 because total U.S. emissions continued to fall in 2016. In general, as natural gas was substituted for coal, emissions from coal fell by over 800 MMTCO₂ while natural gas emissions rose by 249 MMTCO₂. Reductions in petroleum-related emissions almost completely offset the increase in natural gas emissions, and included a net decrease of 124 MMTCO₂ from diesel and motor gasoline use.

According to the U.S. Energy Information Agency, the substitution of natural gas for coal was primarily a market-driven response to lower natural gas prices that occurred as shale extraction technologies matured in the U.S.⁶⁶ Prior to 2008, coal was significantly less expensive than natural gas, and coal supplied about 50% of total U.S. generation. Since 2007, however, gas extraction from shale rose by from 20,196,346 million cubic feet (MCF) to 28,479,288 MCF in 2016, a 41% supply increase in less than a decade. Natural gas prices for energy production fell from a high of \$9.26 per thousand cubic feet in 2008 to \$2.99 TCF in 2016, 71% decline.⁶⁷ Depending on the type of coal, CO₂ emissions range from about 206 to 229 pounds per million British thermal units (btu) of energy compared with 117 pounds for natural gas.⁶⁸ As the U.S. supply of natural gas expanded in response to new shale extraction technologies, and prices fell, a large number of American power producers shifted from coal. Emissions from power generation dropped throughout the country.

Table 2.6

U.S. CO₂ EMISSIONS AND NET AND PERCENT CHANGE BY PRIMARY ENERGY SOURCE, 2007-2016 (MMTCO₂)

	2007	2016	Net Change	Percent Change
Coal	2,172	1,354	-818	-37.7%
Natural Gas	1,246	1,495	249	20.0%
Petroleum	2,576	2,327	-249	-9.6%
Diesel Fuel	647	589	-58	-9.0%
Motor Gasoline	1,211	1,145	-66	-5.5%
Total	5,994	5,176	-818	-13.6%

Source: compiled from the U.S. Energy Information Agency, Total Energy, Table 12.1, Carbon Dioxide Emissions from Energy Consumption by Source, Monthly Energy Review, <https://www.eia.gov/totalenergy/data/browser/?tbl=T12.01#/?f=A&start=1973&end=2016&charted=0-1-13>, accessed February 2018.

The smaller, but still significant reduction in emissions from petroleum use occurred in part from additional substitution of natural gas for higher-emission residual (bunker) oil use in power production and also by reducing emissions from diesel and gasoline use, primarily in on-road vehicles. The vehicular emissions reduction, while more modest, occurred notwithstanding an increase in driving (vehicle miles travelled or VMT) from about 3 trillion to 3.16 trillion miles during 2007-2016. Largely in response to regulatory mandates, during this period vehicle manufacturers reduced the amount of CO₂ emitted per mile by about 17%, and increased average fuel economy by about 20% (see Table 2.7).

The declining trend in conventional combustion engine GHG emissions is consistent with the dramatic improvements in pollution from highway vehicles achieved by federal and state regulators, under the U.S. Clean Air Act and applicable state laws, including in California. As the U.S. EPA has noted, “vehicle pollution control under the Clean Air Act is a major success story,” including the reduction of most tailpipe emissions from passenger vehicles by 98-99% since the 1960s.⁶⁹ U.S. VMT

Table 2.7

U.S. VMT AND EMISSIONS PER VEHICLE MILE AND FUEL ECONOMY TRENDS, 2007–2016

	2007	2016	Percent change
Vehicle Miles Traveled	3,029,822	3,169,203	5%
Grams CO ₂ per mile	431	359	-17%
Miles per gallon	20.6	24.7	20%

Sources: U.S. Department of Transportation, Traffic Volume Trends, December 2017, Annual Averages, <https://www.fhwa.dot.gov/pressroom/fhwa1704.cfm> and U.S. EPA, 2017 Carbon Dioxide Emissions and Fuel Economy Trends Report, Report Tables and Appendices for CO₂ and Fuel Economy Trends. Table 2.1 <https://www.epa.gov/fuel-economy-trends/report-tables-and-appendices-co2-and-fuel-economy-trends> accessed February 2018.

has increased from 1.12 million in 1970 to 3.17 million in 2016. Yet, as shown in Table 2.8, the total tonnage of emissions from all highway vehicles dropped by 71% (nitrous oxides) to 90% (volatile organic compounds) during the same period. Since 2007, regulatory mandates have reduced total highway vehicular mass emissions in the U.S. by about 50% even though VMT rose by 5%.

Much like Germany in the European context, California has notably opted to pursue

Table 2.8

NET CHANGE IN TONS OF TOTAL AIR POLLUTION BY POLLUTANT FROM ALL HIGHWAY VEHICLES 2007–2016

	1970-2016	2007-2016
CO	-89%	-52%
NOX	-71%	-53%
SO ₂	-93%	-56%
VOC	-90%	-49%

Source: US EPA, Air Pollutant Emissions Trends Data, Average Annual Emissions, Criteria pollutants National Tier 1 for 1970 – 2016, Highway Vehicles, <https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data>

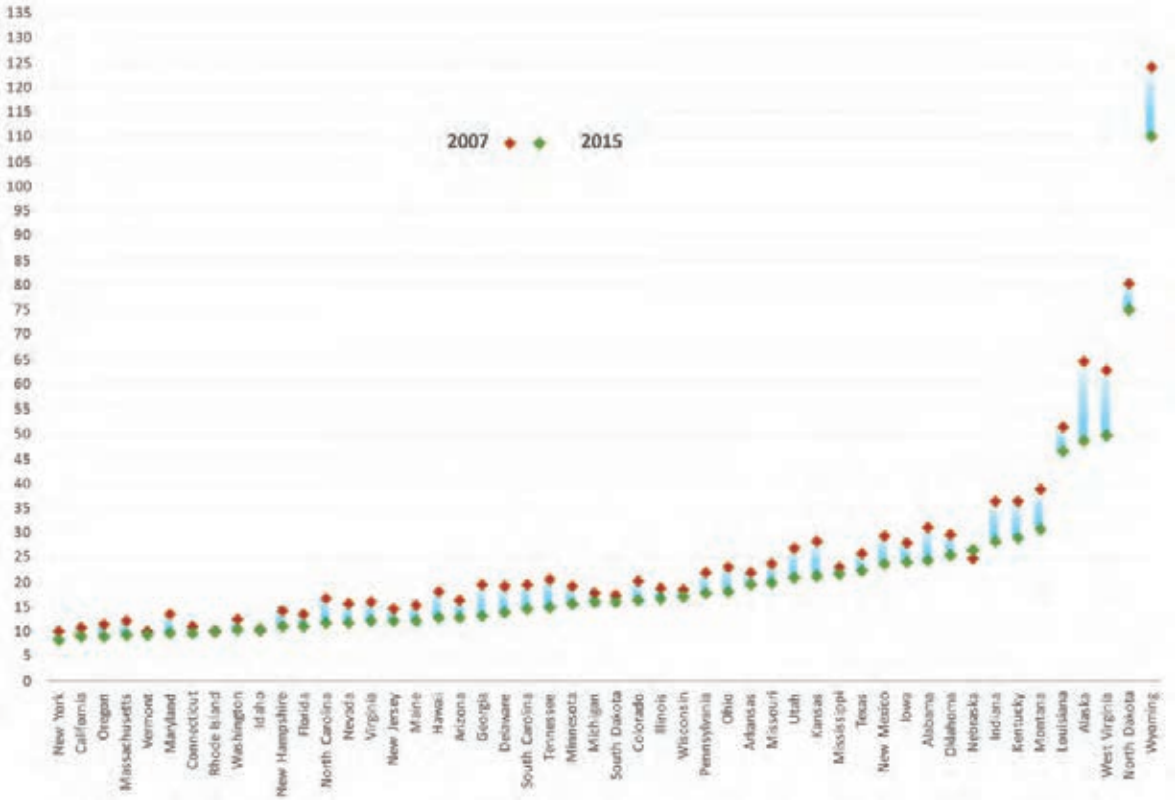
unilateral climate change policies that far exceed national and other state goals in the U.S. and for any major country under the Paris Agreement. The state’s lackluster GHG emission cutbacks to date compared with reductions achieved in places like Alabama, Indiana, North Carolina, or Tennessee—none usually characterized as a climate leader—is partially explained by the fact that the state’s per capita energy use and emissions per unit of economic output has long been among the lowest in the country, in large part due to California’s mild coastal climate.

Figure 2.4 shows the per capita CO₂ emissions for the 50 American states in 2007 (red markers) and 2015 (green markers). In 2007, California had the fifth lowest per capita emissions in the country, and was second lowest in 2015. All of the states that achieved much greater per capita emissions reductions, and in many cases greater or relatively comparable net total reductions, started from higher levels in 2007. In contrast, states with low per capita emissions in 2007 achieved relatively small reductions by 2015. This performance gap reflects the fact that it is much more difficult to achieve major GHG emission reductions in states that are already efficient energy users.

Figure 2.5 shows the CO₂ emissions per million dollars of gross domestic product (GDP) for the 50 American states in 2007 (red markers) and 2015 (green markers). In 2007, California generated just over 200 tons of CO₂ per million dollars of gross state product, one of the lowest GHG emissions per GDP levels in the country. Compared with other states, California made at most a modest reduction in GHG emissions per GDP by 2015 while other states reduced emissions per GDP by a much more substantial amount.

California has notably opted to pursue unilateral climate change policies that far exceed national and other state goals in the U.S. and for any major country under the Paris Agreement.

Figure 2.4
PER CAPITA CO₂ EMISSIONS BY STATE, 2007–2015 (TONS OF CO₂)



Source: U.S. Energy Information Agency, State Carbon Dioxide Emissions Data, October 2017, <https://www.eia.gov/environment/emissions/state/>, accessed February 2018

As shown in Table 2.9, California’s GHG emissions in relation to gross domestic product ranks well below most of the major producers in the world, and just behind France. As discussed in Section 1, however, France obtains 79% of its electrical power from nuclear generation, which emits no GHG or other conventional pollutants. California shut down about 50% of its nuclear generation in 2013, and the last remaining facility, which currently provides 7% of the state’s electrical power, will be closed by 2025.

California and the rest of the United States could substantially reduce GHG emissions through 2030, the initial planning period of the Paris Agreement, by continuing to substitute

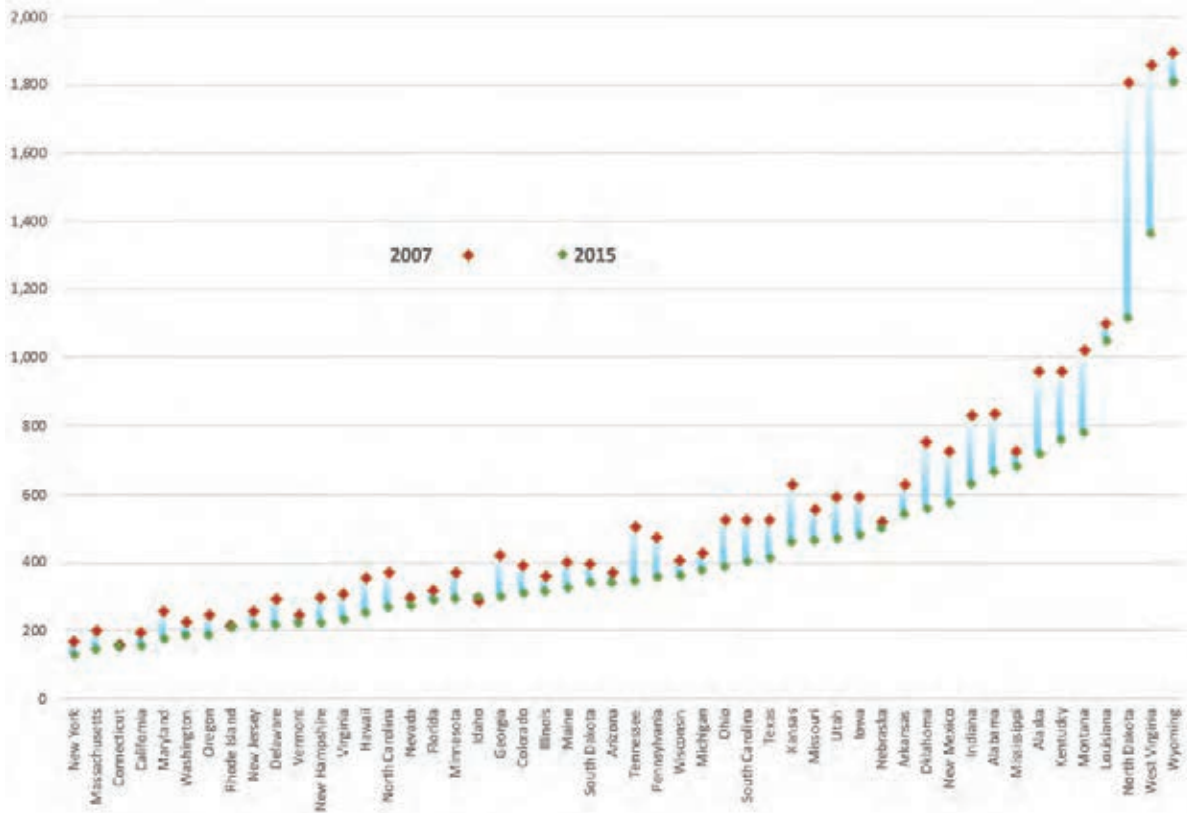
natural gas for coal power generation, or developing comparably clean coal fired facilities. But the 2017 Scoping Plan puts California on a decisively unilateral path far more extreme than any signatory of the Paris Agreement, and that attempts to squeeze additional GHG reductions from an already low baseline of GHG emissions per capita and per GDP.

B. THE UNBOUNDED SCOPE OF THE SCOPING PLAN

The Scoping Plan includes hundreds of measures that will affect every part of life in California. The Scoping Plan identifies

Figure 2.5

METRIC TONS OF CO₂ EMISSIONS PER MILLION DOLLARS OF GROSS DOMESTIC PRODUCT BY STATE, 2007–2015 (chained 2009 dollars)



Source: U.S. Energy Information Agency, State Carbon Dioxide Emissions Data, October 2017, <https://www.eia.gov/environment/emissions/state/>, accessed February 2018

Table 2.9

METRIC TONS OF CO₂E EMISSIONS PER MILLION DOLLARS OF GROSS STATE PRODUCT BY COUNTRY AND CALIFORNIA, 2007–2015
(2011 dollars for listed countries, 2009 dollars for California)

France	186
California	197
United Kingdom	198
European Union	244
Netherlands	252
Germany	254
Japan	296
Mexico	340
South Korea	377
Saudi Arabia	387
Brazil	389
United States	389
Poland	401
Malaysia	412
India	468
Canada	581
Australia	631
Russian Federation	639
China	690
South Africa	728

Sources: PBL Netherlands, Trends in global CO₂ and total greenhouse gas emissions: 2017 report, December 2017, <http://www.pbl.nl/en/publications/trends-in-global-co2-and-total-greenhouse-gas-emissions-2017-report> and California Air Resources Board, 2000-2015 Emissions Trends Report, June 2017, <https://www.arb.ca.gov/cc/inventory/data/data.htm>, accessed February 2018.

the following measures, which include both legislated and unlegislated new mandates, as the “highlights” of the state’s climate change strategy for 2030:

- Boost renewable energy to 50% of the state’s generation.
- Double energy efficiency savings in residential, commercial and other natural gas and electricity end uses already required by the

most recently adopted state and local building codes and similar regulations.

- Reduce the “carbon intensity” of motor fuels by another 18 percent from levels already required.
- Place at least 1.5 million zero emission vehicles (ZEVs), such as plug-in hybrid electric, battery-electric, and hydrogen fuel cell vehicle, in service by 2025 and 4.2 million by 2030.
- Continue to require further GHG reductions from light, medium and heavy-duty vehicles.
- Implement “innovative clean transit options,” including a 20% share of zero emission buses sold in 2018 (rising to 100 percent of new bus sales in 2030), and requiring that all new natural gas buses from 2018 and diesel buses from 2020 meet “optional” heavy-duty low-nitrous oxide (NOX) standards.
- Require the use of low NOX or cleaner engines, and the deployment of zero-emission trucks, for the last 3-7 miles of all deliveries in the state starting with a 2.5% ZEVs in all new delivery vehicle sales in 2020 (rising to 10% by 2025).
- Reduce vehicle miles traveled (VMT) by 15% from the significant future reductions already required by state law, largely through measures designed to promote smaller, high density housing units and inhibit automobile use.
- Reduce methane and hydro fluorocarbon (HFC) emissions by 40% and anthropogenic black carbon emissions by 50% below 2013 levels by 2030.
- Increase the state’s freight system efficiency by 25% by 2030, including the deployment of over 100,000 zero emission-capable freight vehicles and equipment, and powering zero and near-zero emission freight vehicles with renewable energy as much as possible by 2030.

- Extend the state’s existing cap-and-trade program with declining caps to increase the cost of emission allowances for covered GHG emissions in the state.

The Scoping Plan also includes hundreds of additional measures to further reduce GHG emissions across a broader range of daily activities, such as natural gas use (the least costly energy available in California, commonly used for heating and cooking), industrial uses such as manufacturing and refining, waste management, water use, agriculture, natural lands (33% of California is forest), “working” lands used for agriculture and grazing, as well as dramatic new changes to the state’s land use and transportation patterns. The Scoping Plan seeks to modify virtually the daily lives of all California residents, including how water use, transportation mobility, housing options, heating and cooking habits and fuels, and waste disposal. The plan even addresses “enteric fermentation”—flatulence—by modifying the feedstocks for in-state cows, sheep and other livestock. Three appendices further increase the Scoping Plan’s reach:

- Scoping Plan Appendix B lists scores of local municipal code changes, zoning changes, or policy directions for energy, transportation and land use, natural and working lands, agriculture, water, waste management, short lived climate pollutants, green “potentially feasible mitigation measures” for local actions that may significantly affect climate change.
- Scoping Plan Appendix C describes a new “Vibrant Communities and Landscapes” program to be implemented by eight state agencies to maximize local and state GHG emissions and to achieve VMT reductions that CARB asserts are necessary to meet state’s GHG reduction goals for the transportation sector.

- Scoping Plan Appendix I includes a “framework” for “achieving the climate-oriented goals for the building sector.”

Finally, the Scoping Plan includes expert agency determinations for use under CEQA the potential climate change impacts of any “project” requiring a discretionary approval from a local, regional or state agency. These include (1) evaluating whether the project is consistent with: (1) reducing GHG emissions to 6 metric tons per capita by 2030 and 2 metric tons per capita by 2050; (2) achieving an additional 7% VMT reduction by 2030 and 15% by 2050 below the existing legal commitments; (3) new mass emissions, per capita, or per service population emissions CEQA criteria to be developed by local and regional agencies consistent with the Scoping Plan; (4) achieving “net zero increases in GHG emissions; and (5) implementing mitigation measures that reduce VMT and other emissions for projects deemed to significantly affect climate change under the new CEQA guidance in the Scoping Plan.

In the Scoping Plan future, the state’s current shortfall of 3.5 million homes⁷⁰ would be met with small rental apartments, without parking, near public transit. Proposals to require existing communities to accept this infusion of new density have been largely opposed by voters and locally elected politicians across the political spectrum, including in minority communities,⁷¹ and the top target of CEQA lawsuits in California is infill housing.⁷² The Scoping Plan also endorses using CEQA to make it more difficult, or preclude, any new roadway construction that could help address the state’s chronic congestion. Commuting delays have regressive effects on the least affluent, and can spur higher emissions. In 2014, for example, California’s elected leaders concluded that automobile mobility was particularly critical for new immigrants and

lower income workers. Since 2015 California has issued more than one million drivers licenses to undocumented immigrants, as part of a concerted effort to assure that the state's drivers are licensed and insured. Then Assemblyman Luis Alejo, author of a 2014 bill allowing undocumented immigrants to obtain state driver's licenses explained that the right to use a vehicle gives "immigrants a better life" as well as creating a "million new consumers who are buying auto insurance, buying new or used vehicles and renting cars" and "an economic boon for California in the billions of dollars."⁷³

A recent study indicates that 169,000 workers must commute over 2 hours from lower-cost houses in the Central Valley to the costly Bay Area, and make the same trip home again each day.⁷⁴ Rather than help reduce the enormous commute times and family strain experienced by these workers, the Scoping Plan seeks to increase traffic congestion to force more people to take public transit by incorporating and endorsing a 15% VMT "road diet" reduction first proposed by the Governor's Office of Planning and Research (OPR). OPR has responsibility for proposing amendments to the regulatory requirements for implementing CEQA by all state, regional and local agencies statewide.⁷⁵ In 2015, OPR opined that CEQA should consider new roadway construction, including roadway improvements to reduce traffic congestion, as a negative environmental impact because "[b]uilding new roadways, adding roadway capacity in congested areas, or adding roadway capacity to areas where congestion is expected in the future, typically induces additional vehicle travel."⁷⁶ The state's embrace of VMT reduction as a key element of its climate policies ignores the reality that public transit ridership has fallen in California even as billions have been invested in new transit systems⁷⁷ and that fewer than 10% of urban

area Californians (with the exception of ring suburbs located closest to San Francisco) can access a job in less than 60 minutes.⁷⁸ With the exception of the highly concentrated job center in just a portion of the city of San Francisco, jobs in California are highly decentralized, and workers must fan out to thousands of different employers in state metropolitan regions. The low and middle wage commuters priced out of costly urban housing are the most harmed by the CARB and OPR decisions to deploy CEQA to require VMT reductions.

In addition, all discretionary public agency decisions, including for infill housing, in California have become more vulnerable to legal challenges based on alleged inconsistency with the Scoping Plan CEQA guidance. Any project can be delayed, or possibly stopped entirely, by lawsuits based on the Scoping Plan's newly-created per-capita emission "targets" for 2030 and 2050, "net-zero" impact standard, and the feasibility and adequacy of GHG emission mitigation. The injection of new GHG-related criteria into the CEQA process extends the state's climate change policy beyond anything that has ever been proposed under the Paris Agreement, by any other state, or even by any other country.

C. THE CHALLENGES OF UNILATERALISM

The Scoping Plan envisages that California will, on its own, cut GHG emissions from the current level of 11.3 tons per capita to 6 tons per capita by 2030, or about the level of Turkey, and to 2 tons per capita by 2050, close to the per capita emissions of Nigeria. The following sections discuss some of the challenges this unilateral approach is likely to encounter and the possibility that the state's policies may,

however unintended, increase global GHG emissions rather than reduce them.

1. Renewable energy and complementary fossil fuel generation

The Scoping Plan requires that renewables comprise 50% of the total retail sales by state load-serving entities (LSEs), which consist of larger public and private electrical power generators, produce half of the state’s energy generation by 2030. California’s goal is substantially greater than the 35% renewable power goal announced, but not yet approved, by the EU Parliament earlier this year. Unlike the EU, California does not count large-scale hydroelectric power as a renewable resource, and will completely close its last remaining nuclear generation facility by 2025.

Although California technically allows for the use of biomass as a renewable power source, environmental opposition has greatly reduced the potential for biomass generation in the state. Even though there are millions of dead and dying trees in the state’s badly

mismanaged forests, environmentalists also opposed culling dead trees and high fire hazard underbrush from the forest lands that cover 33% of California, generally citing species protection concerns. The lack of available wood-based biofuels has caused the number of operating biomass facilities to fall.⁷⁹ As shown in Table 2.10, wind and solar power account for almost all of California’s net increase in renewable generation since 2007 and will likely continue to dominate the state’s renewable generation growth in the future.

As in the EU, the increase in intermittent solar and wind power in California has produced a growing time of use (TOU) mismatch between statewide demand and the periods during which renewable power is available. Solar energy, the fastest growing renewable power source in the state, peaks at mid-day when demand is lower, and is unavailable in the late afternoon and early evening when workers, students and other residents return home and use electricity for lighting, cooking, entertainment or heat. This pattern of surplus renewable energy in the afternoon, when demand is lower, and renewable electricity shortfalls in the evening when consumers return home to cook, heat or cool their homes, watch television, and use lighting and other appliances, is commonly referred to as the “duck curve” as shown in Figure 2.6.⁸⁰

The amount of excess renewable power generated in the afternoon in California rose to 300,000 megawatt hours (MWh) in 2016, about the annual energy consumption of 45,000 homes in the state.⁸¹ As in Germany, California grid operators have difficulty dumping excess renewable power since operators in other states are also trying to balance their energy demand and production. In many cases, California had to resort to “negative pricing” of its excess energy (e.g., “negawatts”), and California ratepayers have actually paid adjacent states to

Table 2.10

TOTAL CALIFORNIA IN-STATE ELECTRICAL GENERATION AND RENEWABLE GENERATION BY SOURCE 2007 AND 2016 (Gigawatt Hours)

	2007	2016
Total Instate Generation	209,856	198,227
Renewable Generation	28,463	55,300
<i>Biomass</i>	5,398	5,868
<i>Geothermal</i>	12,999	11,582
<i>Small Hydro</i>	3,675	4,567
<i>Solar</i>	668	19,783
<i>Wind</i>	5,723	13,500
Percent In-state Generation from Renewables	14%	28%

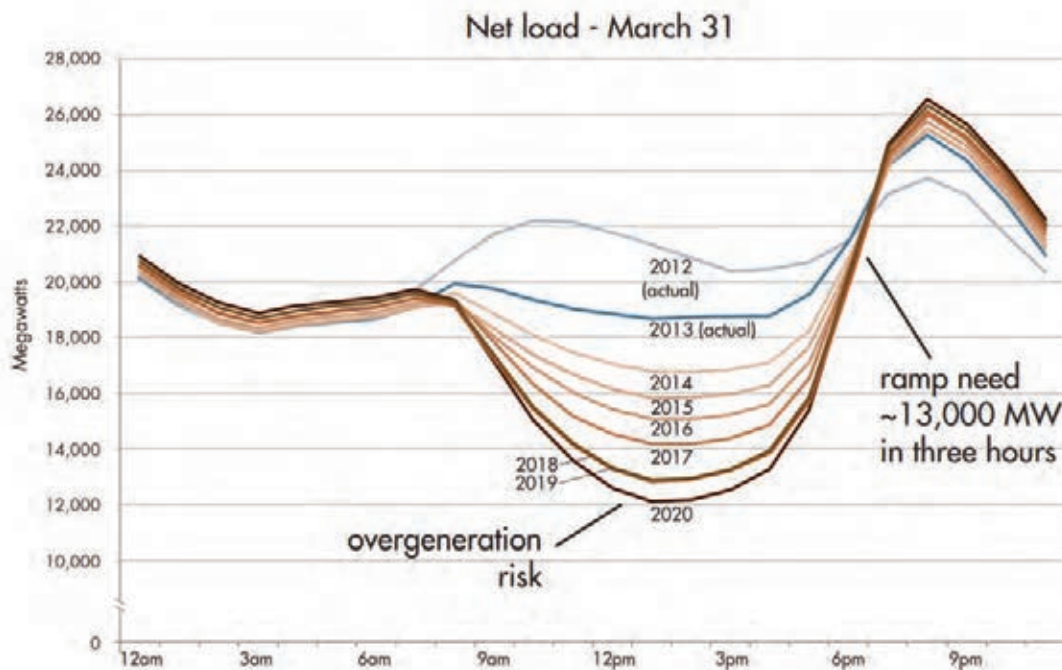
Source: California Energy Commission, Total System Electric Generation, 2016 and 2007, http://www.energy.ca.gov/almanac/electricity_data/total_system_power.html, accessed February 2018

use excess afternoon renewable energy.⁸² There are as of yet no cost-effective and feasible means for storing solar or wind power for use when actually needed.⁸³ In late 2017, for example, Southern California Edison (SCE) and Tesla collaborated on a power storage battery facility that can store about 80 MWh of electricity, an amount comparable with the daily demand of 2,500 homes, or 4 hours' worth of demand from 15,000 homes, in the state. The storage unit consists of 398 lithium-ion batteries that each weigh 3,500 pounds and 24 inverters that each weigh about 2,600 pounds within a 1.5

acre site.⁸⁴ Installing 4 hours of storage for each household in the state would require about 5,200 facilities similar to the SCE installation, or more than 2 million powerpacks, about 125,000 inverters and 12 square miles of land. Battery deployment on such a massive scale using existing technologies would also require obtaining relatively rare raw materials, such as lithium, nickel, graphite and cobalt, from politically unstable, socially exploitative and environmentally damaging sources. More than half of the world's supply of cobalt is mined in the Democratic Republic of the Congo (DRC)

Figure 2.6

POTENTIAL OVERGENERATION OF RENEWABLE PRODUCTION RELATIVE TO DEMAND, CALIFORNIA ELECTRICITY SUPPLY AND DEMAND ON MARCH 31 (as of 2013) BY TIME OF DAY (“Duck Curve”)



Source: Paul Denholm et al, Overgeneration from Solar Energy in California: A Field Guide to the Duck Chart, National Renewable Energy Laboratory, November 2015, <https://www.nrel.gov/docs/fy16osti/65023.pdf>, accessed March 2018. The chart was reproduced from a 2013 California Independent Operator (ISO) analysis and shows that as base demand falls midday, when solar energy production peaks, the ISO will need to begin dispatching other generation to meet much higher demand later in the day and early evening.

and includes the use of children in dangerously narrow tunnels. Very little tangible progress has been made to reform these “blood battery” labor practices in the DRC.⁸⁵ Nickel mining has been linked with serious environmental damage and worker disease in the Philippines, Colombia and Russia.⁸⁶ Graphite mining is known to damage crops, homes and personal property from soot deposits, respiratory disease, and polluted drinking water.⁸⁷

Until a cost-effective and ethically acceptable storage solution is invented, adding intermittent solar and wind energy generation to any large-scale grid will require an alternative, more reliable power source to meet peak demands and provide power when solar is unavailable (i.e., cloudy days and at night) or there is insufficient wind to power the state’s turbines. As discussed in Section 1, France relies on nuclear power for its electrical baseload, while Germany uses highly polluting lignite generation plants. As shown in Table 2.11, California primarily relies on two sources

to complement intermittent renewable power sources: (a) in-state natural gas used primarily to power fast-reacting CCGT plants; and (b) imported power from other states. The state’s nuclear power is being discontinued, and, unlike the EU, large hydropower has been explicitly excluded from the state’s definition of renewable energy sources due to environmental opposition.

California’s use of in-state natural gas and out of state imports to produce necessary electric supplies—particularly in the absence of the large-scale feasible battery storage—required to support the state’s desired reliance on solar and wind was quietly demonstrated during the August 21, 2017 solar eclipse. Although the sun was not totally obscured within the state, during 10 A.M to 11 A.M., when the partial eclipse was at its greatest extent, California solar generation fell from an average level of about 9.1 gigawatts during this period to just 3.1 gigawatts, a 60% decline. The state’s grid operators compensated for this renewable energy supply disruption by ramping up power from fast-reaction natural gas facilities and importing more power from out of state. Natural gas generation increased by 3.7 gigawatts and imports rose by 2.2 gigawatts during the peak periods of the eclipse.⁸⁸ The eclipse was a relatively unique event and known well in advance. California grid operators must manage similar, but unpredictable renewable power intermittency on a daily basis due to weather, as well as demand fluctuations, by adjusting in-state fast reaction fossil fuel generation and imported energy on a continuous basis.

Recent research has demonstrated that, with existing solar, wind and battery technologies, there is a clear relationship between the increased use of fast reacting non-intermittent power sources, primarily natural gas powered CCGT and similar facilities, and

Table 2.11

TOTAL CALIFORNIA IN-STATE ELECTRICAL GENERATION BY SOURCE 2007–2016 (Gigawatt Hours)

	GWh	Percent of total
Total Energy Generation	290,567	
In-state natural gas	98,831	34%
Imported Electricity from other states	92,341	32%
Imported wind power	12,822	4%
Imported solar power	3,791	1%
In-state solar and wind	33,283	11%
Nuclear and large hydropower	43,341	15%
Biomass, geothermal small hydropower	22,017	8%
Coal, oil and petroleum coke	755	0.3%

Source: California Energy Commission, Total System Electric Generation, 2016
http://www.energy.ca.gov/almanac/electricity_data/total_system_power.html, accessed February 2018

intermittent renewable energy. In locations that have abundant hydroelectric or nuclear power, such as Washington State or France, renewables can be operated with lower or no emissions in conjunction with stable, baseload power sources. In locations like California, which have elected to not develop new hydroelectric power and to eliminate all nuclear power sources due to environmental advocacy, natural gas has been proven necessary to facilitate the state's expansion of renewable power. A 2016 National Bureau of Economic Research study of renewable energy diffusion in 26 larger countries concluded that fast reaction fossil fuel (FRF) generation capacity, such as CCGT gas plants technologies, is directly associated with the growth of renewable power sources. The failure to recognize the complementary relationship between renewables and FRF facilities was found to result in "an underestimation of the costs of renewable energy integration."

[A]bsent economically viable storage options, countries where FRF capacity was available were more likely, ceteris paribus, to invest in renewable energy generation. While short-run effects are low, in the long run the relation between FRF and RE capacity has been almost a one-to-one increase (i.e. 0.88%)....

As the share of RE increases, so will the requirements for increased back-up capacity and serious stresses will be put on the energy system unless the relationship and the complementarity between FRF and RE technologies are appropriately acknowledged...[A] policy and academic debate centered on the juxtaposition of renewable (clean) and fossil (dirty) technologies misses this important point, leads to an underestimation of the costs of renewable energy integration, and does not contribute to stressing the importance

*of funding and developing solid alternative options such as cheap storage technologies.*⁸⁹

The NBER study is consistent with other analyses concluding that the rapid and largely unforeseen growth in natural gas supplies from U.S. shale extraction would not displace and instead will support expanded renewable power capacity in the U.S.⁹⁰ The need to support renewables with stable, rapidly fast reaction fossil fuel power is one reason why the California Energy Commission recently concluded that new building energy efficiency standards cannot feasibly achieve "zero" net greenhouse gas emissions with existing renewable energy and storage technology.⁹¹ For California, these findings suggest that the state is unlikely to substantially reduce its use of fossil fuel baseload and backup power generation use from in-state and out of state suppliers for the foreseeable future.

2. Chronic GHG emission leakage from state relocation, corporate supply chains, and imports.

By law, California climate policy is supposed to account for and avoid GHG emission displacement, or "leakage" to other states and countries. The Scoping Plan simply states that while "relocation of production" would reduce in-state emissions, "this is disadvantageous for a couple of reasons" including (1) inconsistency with the state's legal mandate to minimize leakage, and (2) a loss of jobs and a tax base that "supports local services such as public transportation, emergency response, and social services" and "funding sources critical to protecting the natural environment and keeping it available for current and future generations."⁹² The state Legislative Analyst's Office (LAO) recently concluded that information about the effects of state policies on emissions leakage, such as the cap and trade program, is at best "limited."⁹³

Yet, adequately analyzing the nature and extent of potential GHG emission leakage from the state is crucial for the success of California’s GHG reduction measures, which must be measured by global, not just state, emissions. There is substantial evidence that the state has stimulated and will continue to induce emissions increases in other locations that are currently unaccounted in California, allowing California to claim instate GHG reductions that are offset by emission increases in other states and countries.

(a) Direct household and business movement to high emission locations.

California continues to lose domestic population and business activity to other states and countries. According to the LAO, for example, California experienced a net loss of about 1 million former residents to other

Table 2.12

GHG EMISSIONS CHANGE ATTRIBUTABLE TO CALIFORNIA NET DOMESTIC MIGRATION 2010–2017 AND ESTIMATED 2010–2030 (POPULATION AND TONS OF GHG EMISSIONS)

	2007-2016	2010-2030 (2017-2030 estimated from 2006-2016 trend)
Net Domestic Migration from California	-1,000,000	-2,400,000
California per capita GHG emissions	11.3	11.3
Rest of US per capita emissions	22	22
Instate total emissions	11,300,000	27,120,000
Average emissions in rest of US	22,000,000	52,800,000
Net change from domestic migration	10,700,000	25,680,000

Sources: See Table 2.2 for emission data sources; net domestic migration data from Brian Uhler, California Losing Residents Via Domestic Migration, California Legislative Analyst’s Office, February 21, 2018, <http://lao.ca.gov/LAOEconTax/Article/Detail/265>, accessed March 2018.

states, particularly Texas, Arizona and Nevada, during 2007 to 2016.⁹⁴ As shown in Table 2.12, per capita emissions in California in 2015 were about 11.3 tons compared with 22 tons in the rest of the nation. As a result, the net domestic migration from California resulted, on average, in a net annual increase of approximately 10.7 MMTCO₂e. If domestic migration continued to occur at similar levels through 2030, population shifts alone from California would result in a net annual increase of about 25.7 MMTCO₂e. California’s GHG emission reduction program ignores the increased emissions caused by population leakage to higher per capita GHG emission states.

(b) Embedded GHG Emissions in California supply chains and imported products.

California’s GHG reduction accounting also ignores GHG emissions from products consumed by Californians, but manufactured and transported from other states and countries. A substantial amount of the California economy is supported by high-emission activities in other locations. Many, if not most of these product-based GHG emissions reflect long-term siting and supply decisions based on energy and labor costs, or environmental and other regulatory restrictions, rather than actual relocations from the state.

California’s high tech economy illustrates the GHG accounting problems created by California’s focus on only in-state activities. Apple Inc., Alphabet Inc. (Google) and Facebook are the three largest public companies in California, and, as of the end of 2017, three of the five largest in the United States, based on market capitalization. Each of these firms uses energy and produces GHG emissions to make products, such as smartphones and computers, and to power and cool large online data centers.

As shown in Table 2.13, Apple Inc., Alphabet Inc. and Facebook self-reported total annual emissions of more than 33 MMTCO_{2e} in 2015 and 2016, an amount equal to about 8% of total California emissions in 2015.

Very little of these GHG emissions – or the manufacturing jobs that correspond to the product production activities that emit GHG emissions - are located in California. About 77% of Apple’s total emissions are related to manufacturing, largely in China. In 2015 Alphabet consumed about 5,743 GWh of electrical power, nearly the same as the entire County of San Francisco in 2016. About 34% of this consumption occurred outside the U.S., and most of the remaining power was used in large data centers located outside of California.⁹⁵ Facebook consumed 1.83 million MWh in 2016, the annual electrical consumption of about 60,000 homes in California. About 96% of Facebook’s electrical consumption occurred in the company’s data centers, most of which are located outside California.⁹⁶ Many apparently “clean and green” technologies, such as Bitcoin, depend on very significant, if generally obscured, GHG emissions.⁹⁷

Similarly, while the Scoping Plan supports the development of electric vehicles (EVs), each requires significant amounts of energy to manufacture the batteries as well as other components that make EVs possible. Focusing just on battery production, EV battery manufacturing has been estimated to require 150-200 kg of GHG per KWh of battery capacity.⁹⁸ Most electric vehicles are able to travel about 3 miles per KWh in combined highway and urban driving conditions, and typical EVE battery sizes range from 20-30 KWh (e.g., a Nissan Leaf) to 75-100 KWh (e.g., luxury Tesla EV models). The Scoping Plan calls for the deployment of 4.2 million EVs by 2030. Assuming these vehicles have an average storage capacity of 50 KWh, or about a 150 mile range per charge, the embedded GHG emissions

in the batteries imported to the state from manufacturers in China, Japan or the Tesla plant in Nevada would be about 42 MMTCO_{2e}. Virtually none of these battery-related emissions will occur in the state. Yet California’s climate regulators can claim the GHG reductions from the diffusion of EVs in the state while ignoring the GHG emissions required to produce the EV batteries (or other manufactured car components) for these vehicles.⁹⁹

In addition, many products utilized by California residents are not manufactured in the state. It is possible to estimate the GHG emissions embedded in California’s imports from other countries using data collected by the U.S. Department of Commerce and the reported average GHG emissions per unit of production value in each exporting country.¹⁰⁰ In 2015, California imported about \$408 billion in products from other nations, an amount equal to about 16% of the state’s total GDP. Excluding petroleum imports, which are

Table 2.13

SELF-REPORTED ANNUAL GHG EMISSIONS, APPLE INC. (2016), ALPHABET INC., AND FACEBOOK, 2015 (MMTCO_{2e})

	Company-reported GHG Emissions
Apple (2016)	29,500,000
Alphabet (Google) (2015)	2,996,834
Facebook	718,000
Total	33,214,834
Percent of California 2015 Emissions	8%

Sources: Apple Inc., Environmental Responsibility Report, 2017 Progress Report, Covering Fiscal Year 2016, https://images.apple.com/environment/pdf/Apple_Environmental_Responsibility_Report_2017.pdf; Alphabet Inc., Google Environmental Report, December 2016, <https://abc.xyz/investor/pdf/google-2016-environmental-report.pdf>; Facebook, Our Footprint, <https://sustainability.fb.com/our-footprint/>, accessed February 2018.

Table 2.14

ESTIMATED GHG EMISSIONS FROM MANUFACTURING IMPORTED GOODS, CALIFORNIA, 2015

Larger Non-Petroleum Import Sources to California	Value of Imports (millions of USD)	Metric tons of GHG per million dollars of GDP	Estimated emissions to produce value imported by California
China	143,620	690	99,097,800
Mexico	45,086	340	15,329,240
Japan	38,478	296	11,389,488
Canada	27,862	581	16,187,822
Malaysia	16,817	412	6,928,604
Korea, South	15,390	377	5,802,030
Taiwan	12,526	283	3,544,858
Germany	12,706	254	3,227,324
Thailand	10,043	381	3,826,383
United Kingdom	4,562	381	1,738,122
Total of large source nations	327,090	400¹⁰¹	130,672,455
Other non-petroleum imports ¹⁰²	57,157	400	22,834,222 ¹⁰³
Total	384,247	400	153,506,677

Sources: State import data from U.S. Census Bureau, Total U.S. Imports to California and Top 25 6-digit HS Commodities Based on 2017 Dollar Value, <https://www.census.gov/foreign-trade/statistics/state/data/imports/ca.html> and national GHG intensity data for 2015 from PBL Netherlands, Trends in global CO2 and total greenhouse gas emissions: 2017 report, December 2017, <http://www.pbl.nl/en/publications/trends-in-global-co2-and-total-greenhouse-gas-emissions-2017-report>, accessed February 2018.

discussed separately below, products imported to the state totaled about \$384 billion. As shown in Table 2.14, based on the reported rate of emissions per unit of economic output for exporters to California, the total GHG emissions embedded in California’s imports for 2015 was about 155 MMTCO₂e, or 35% of the California’s total reported emissions in 2015. California climate regulators, and elected leaders, completely ignore the GHG emissions associated with products manufactured outside of, but consumed in, the state.

There are no readily available statistics concerning the amount and embedded GHG emissions in products and other non-energy imports consumed in California but imported from other states within the U.S. It is likely that the aggregate amount of these emissions is substantial. As noted above, new car sales

in California, for example, were about 2 million vehicles in 2017.¹⁰⁴ Relatively few of these vehicles, and very few major automotive components, such as batteries, electric motors, internal combustion engines and chassis assemblies, are manufactured in the state. GHG emissions required to manufacture passenger vehicles vary with size, power source and other factors. In Europe, conventional vehicle manufacturing has been estimated to require 7.5 tons of CO₂e per car and EV vehicles require about 10.5 tons, largely due to the additional energy required to fabricate electric vehicle batteries.¹⁰⁵ In 2016, in California about 5% of in-state car sales were zero emission vehicles. Assuming conventional and electric vehicle production in the US, Asia, and other source countries is about as efficient as in Europe, the embedded GHG emissions just for a single

product – cars – purchased by Californians exceed about 15 MMTCO₂e per year. If half of the vehicles purchased in California were produced in other states, the embedded GHG emissions from interstate sources would be about 7.5 MMTCO₂e per year. The amount of GHG emissions embedded in California’s interstate imports is likely many times this level, including from energy, food, building materials, recreational products, clothing, household goods, internet and data facility services, and other products or services consumed but not produced in the state. As with foreign imports, California’s climate policies ignore the embedded GHG emissions in interstate imports.

The scope of California’s embedded GHG emissions is potentially enormous because environmental restrictions and other factors discussed below have reduced, or in some cases completely eliminated, the state’s ability to manufacture or even assemble most of the goods consumed in California, even when it has substantial resources for doing so. For example, about 33% of California – an area the size of New York State – is forested. Despite a well-recognized and urgent need to remove excess vegetation, including over 100 million dead trees and excess underbrush that have been allowed to proliferate in an overly dense manner, California imports all of its manufactured wood consumption, such as plywood or composite materials used for homes and buildings, and from 80-90% of all of lumber needs. The policy and ideological gridlock that has allowed this perverse outcome to occur was criticized in a nonpartisan state 2018 Little Hoover Commission report documenting the “unprecedented environmental catastrophe” caused by “a century of mismanaging” state forests.¹⁰⁶ The report notes that sourcing more wood used within California from the state would help foster sustainable wood harvesting and allow Californians to better control the

negative externalities of instate wood use. “Many Californians are proud of the state’s reputation as an environmental leader,” the Commission concludes, “but environmental gains are not made by pushing negative impacts outside of the jurisdiction of the environmentally conscious.”¹⁰⁷

The fact that California climate regulators and elected leaders only count (and heavily regulate) GHG emissions from instate California manufacturing creates another regulatory cost burden which can be ignored if instate manufacturers move their operations—including both jobs and GHG emissions—to other states or countries.

(c) California’s dependence on energy imports.

California imports more energy than any other state. As shown in Table 2.14, 66% of the crude oil refined in the state, 91% of all natural gas used for power generation and other residential, commercial or industrial uses, and (notwithstanding the largest agricultural sector in the country) 88% of the ethanol the state mandates for blending into motor fuels, is imported from other states and countries. In addition, 33% of the state’s 2016 electrical consumption (over 92 GWh), was provided by electrical power generated in and imported from other states. The amount of electricity imported by California was more than the total retail electrical sales of all but 13 U.S. states, including Washington (88.8 GWh), Arizona (78.2 GWh), New Jersey (75.3 GWh), Oklahoma (61.5 GWh) and Colorado (54.8 GWh).¹⁰⁸

As noted by the state’s non-partisan Little Hoover Commission, California’s reliance on imported energy allows the state to ignore the GHG emissions from most of these sources, as well as significant portions of the production, refining and manufacturing, and transportation

of its energy supplies. California has no jurisdiction to regulate how the over 90% of the natural gas it utilizes is extracted, stored or transported outside the state’s borders. Even a single leak in the natural gas system, such as the 2017 discharge of methane from the in-state SCE Aliso Viejo underground reservoir, can result in a discharge of over 2.4 million tons of CO₂e.¹⁰⁹ Similarly, the state does not produce – and continues to face legal challenges as it tries to regulate¹¹⁰ – about 88% of the fuel ethanol it utilizes. Consequently, the methods – and labor as well as environmental standards – used to manufacture over 33 billion gallons of ethanol per year imported to California, including water, fertilizer, pesticide, and growing and harvesting equipment use, are effectively outside California’s jurisdictional control.

The state’s dependence on imported electrical power is particularly critical. In-state power providers are required to meet the Scoping Plan renewable energy mandates and offset emissions from power generation from non-renewable power by buying allowances under the California cap and trade program. State law also precludes in-state providers from entering into long-term contracts to buy out of state energy produced from high-emission sources, such as coal. The intent of these

provisions is to create incentives for state power providers to increasingly rely on low or non-emission electrical generation that meets the state’s renewable portfolio criteria. There are three major problems with this approach.

First, since imports in part are used to compensate for the unpredictability or absence (e.g., nighttime for solar power) of electricity produced from renewable sources, much of California’s imported electricity is purchased on the spot market or on a temporary basis. California cannot control how this out-of-state energy is produced. A substantial amount of the state’s electricity imports—39.9 GWh, or 13.4% of total consumption in 2015, for example— are identified by the California Energy Commission as coming from “unspecified” sources. Based on the reported emissions identified by CARB for these imports, the state apparently assumes that emissions from the unspecified electrical imports are about 280 tons of CO₂e per GWh. Emissions from known imported sources, however, which accounted for 59 GWh and 20% of the state’s electrical consumption in 2015, had much higher average emissions of 380 tons of CO₂e per GWh. If the unspecified portion of the state’s imports have the same emissions per unit as the known electricity imports, total electrical GHG emissions for the state would

Table 2.14

CALIFORNIA ENERGY IN-STATE PRODUCTION AND IMPORTS, 2016

	Total Consumption	In-state production	Imports from Other States	Percent imported
Crude Oil (thousand barrels)	602,860	205,582	397,278	66%
Natural Gas (million cubic feet)	2,248,363	205,024	2,043,339	91%
Electric power (GWh)	290,567	198,227	92,340	32%
Ethanol Thousand barrels	37,803	4,725	33,078	88%

Sources: U.S. Energy Information Agency <https://www.eia.gov/state/analysis.php?sid=CA>; https://www.eia.gov/state/seds/data.php?infile=/state/seds/sep_fuel/html/fuel_use_en.html; California Energy Commission, Total System Electric Generation, 2016, http://www.energy.ca.gov/almanac/electricity_data/total_system_power.html, accessed February 2018.

have been nearly 4 MMTCO₂e higher than reported in 2015.

Even with the state's apparently generous accounting for "unspecified" electrical imports, GHG emissions from imported energy accounted for 40% of all California electrical power emissions in 2015. According to CARB, in-state generation produced 254 tons of CO₂e per GWh versus an average of 340 CO₂e per GWh for imports. California's substantial reliance on electricity imports requires the use of energy sources that produce an average of 33% more emissions per GWh than in-state power. In addition, California's ratepayers paid a premium price for energy for the jobs and revenues attributable to California's electricity imports from these out-of-state power producers.

Most critically, California's pricing penalties for non-renewable electrical generation, including the need to purchase emission cap and trade allowances and lack of subsidies available for preferred, renewable power sources, unintentionally creates incentives to "shuffle" out of state generation in a manner that does not actually reduce, and can substantially increase, overall global GHG emissions. California's use of renewable power will only cut global emissions if the energy production that in-state providers do not use, such as from coal facilities, is retired rather than resold to another user. The state's policies instead create opportunities for non-California power producers to sell cleaner power at higher prices for California use, and then to continue selling, rather than eliminating, coal and other fossil fuel power production to other consumers.¹¹¹ A Stanford researcher has estimated that the amount of the emissions from California-based resource shuffling could range from 108 to 187 MMTCO₂e by 2020.¹¹² At the high end of this estimate, GHG emissions from shuffling in 2020

would exceed the 182 MMTCO₂e of reductions from 2015 levels California is required to achieve by 2030 under the Scoping Plan.

California's continued reliance on oil imports also results in uncounted GHG emissions and are inconsistent with progressive political objectives. As shown in Figure 2.7, largely as a result of new shale oil recovery technology, U.S. domestic crude oil production nearly doubled during 2007-2016. Imports fell by 22%, and the imported share of total U.S. crude oil production fell from 66% to 47% over the same period. The U.S. was also able to shift a substantial amount of its imported crude oil from Persian Gulf suppliers (Saudi Arabia, Qatar, Kuwait, Iraq, Bahrain and the United Arab Emirates) which fell by 18%, to Canadian sources, which rose by 41%.¹¹³ In the most recent rankings of national political and civil liberties published by Freedom House, Canada earned almost perfect (99 of 100) freedom ranking, well above the score of 86 for the United States, while none of the Persian Gulf suppliers ranked higher than 150th of 209 countries. Saudi Arabia, the largest supplier from the region, ranked 201st with an aggregate score of just 7.¹¹⁴

Yet, despite the dramatic increase in U.S.-produced crude oil and growing oil supply integration with Canada, California's oil supply trends have largely moved in an opposite direction. As shown in Figure 2.8, while the state has substantial remaining hydrocarbon resources, in-state production fell from 2007-2016. Alaskan oil supplies (not shown in Figure 2.8) also declined. To meet demand, California increasingly relied on foreign crude oil imports, which currently exceed 50% of the state's total crude oil consumption. Imports from Saudi Arabia increased to over 108 million barrels by 2016, 34% of the state's total imports, compared with 7 million barrels from Canada, or 2% of the state's imports.¹¹⁵ In 2016 California

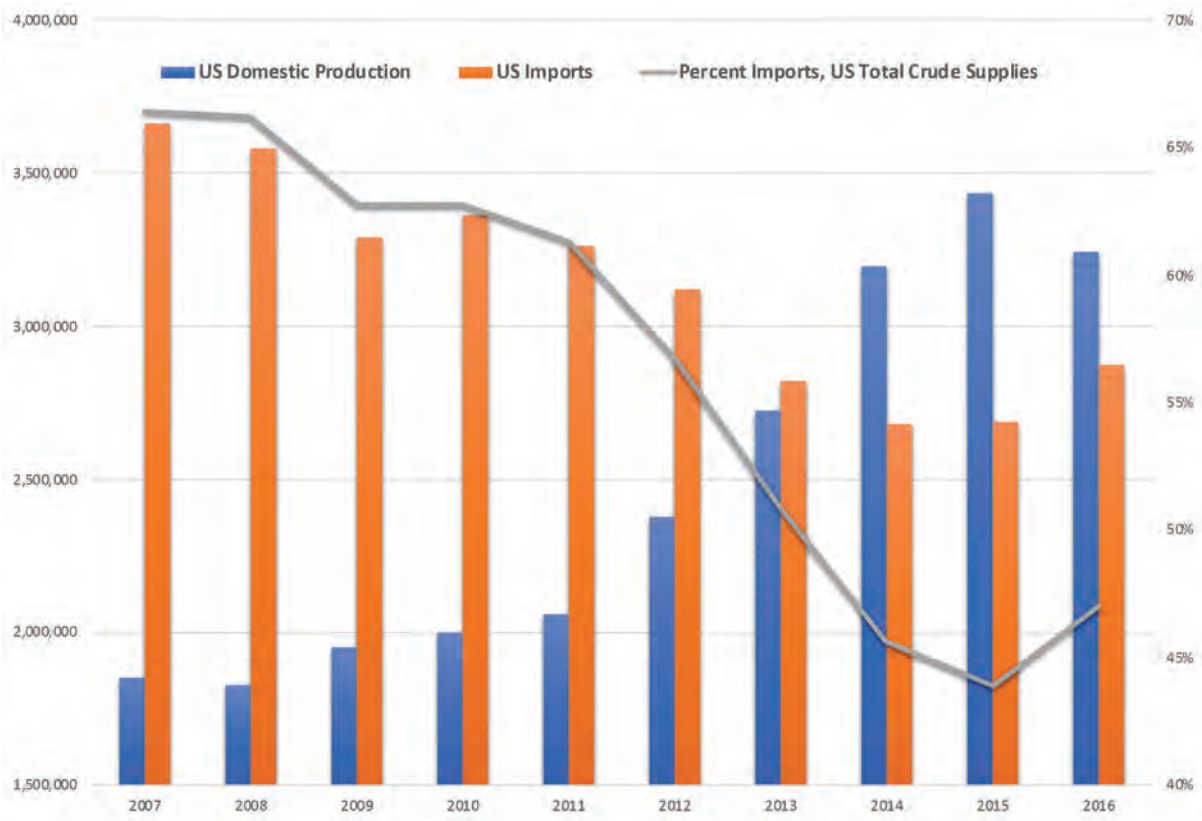
accounted for 23% of total U.S. imports from the Persian Gulf, and 27% of imports from Saudi Arabia.¹¹⁶

California’s growing reliance on crude oil imports from politically repressive countries is largely the result of the state’s climate change policies and environmental group opposition to U.S. and North American oil and gas industry development. The state has implemented, and will continue to pursue as part of the Low Carbon Fuel Standard element of Scoping Plan, efforts to “decarbonize” its petroleum consumption, including by using lighter grades of crude oil. Existing in-state fields generally produce heavier crude oil, and politically it

has been difficult to develop shale and other “tight” oil supplies in California that produce lighter crude oil in other locations, including the Bakken formation in North Dakota. Unlike natural gas, California has no crude oil pipeline connections with other states. Natural gas from shale formations can be imported into California via existing pipelines, lighter crude must be transported from inland locations in the U.S. and Canada, usually by rail. Many in-state environmental groups oppose the use of Canadian and U.S. inland produced crude oil because they believe such production, which includes the use of new, hydraulic fracturing or oil sand technologies, is energy intensive,

Figure 2.7

U.S. DOMESTIC AND IMPORTED CRUDE OIL PRODUCTION (thousands of barrels, scale left) AND IMPORTS AS A PERCENT TOTAL CRUDE OIL CONSUMPTION (scale right), 2007–2016



Sources: U.S. EIA, U.S. Imports by Country of Origin, https://www.eia.gov/dnav/pet/pet_move_impqus_a2_nus_epc0_im0_mbb1_a.htm and Crude Oil Production, https://www.eia.gov/dnav/pet/pet_crd_crdpn_adc_mbb1_a.htm, accessed February 2018.

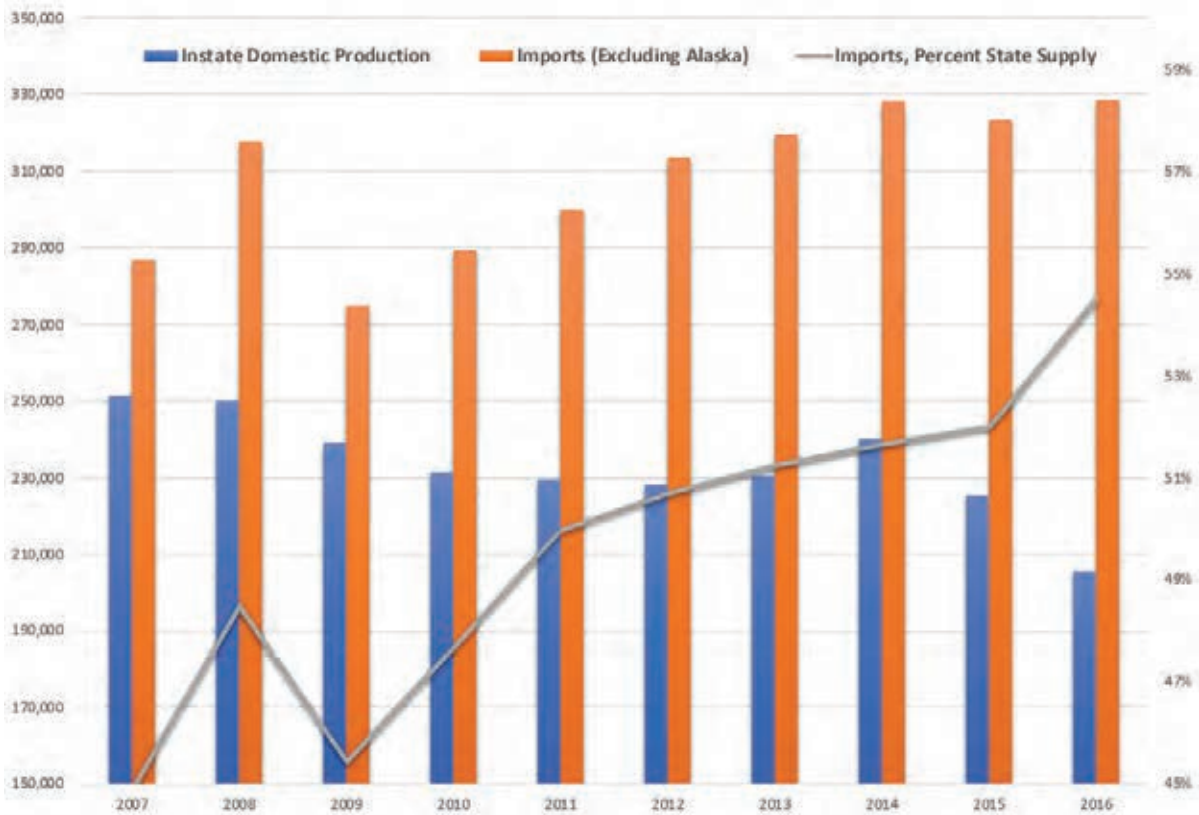
environmentally damaging, and inconsistent with the goal of transitioning to a fossil fuel free future. Transportation by rail has also been successfully opposed due to safety and other concerns.¹¹⁷ Opposition to oil pipelines and rail transport has largely succeeded in barring oil imports to California from the lower 48 states and Canada.

The major sources of relatively light and clean crude oil that California has been willing to use are produced outside North America in locations the state has no ability to regulate,

and occur in countries that do not embrace California’s environmental, labor, and social equity values. California is also more vulnerable to political disputes and pricing and supply fluctuations involving oil-producing countries. In furtherance of its opposition to the domestic fossil fuel infrastructure, the state is spending billions of dollars per year on crude oil from regimes that have especially poor records on gender and LGBT rights – as well as many other social and political values that are ordinarily more politically influential in California – and

Figure 2.8

CALIFORNIA IN-STATE AND IMPORTED CRUDE OIL PRODUCTION (thousands of barrels, scale left) AND IMPORTS AS A PERCENT TOTAL CRUDE OIL CONSUMPTION (scale right), 2007–2016



Source: California Energy Commission, Crude Oil Supply Sources to California Refineries, http://www.energy.ca.gov/almanac/petroleum_data/statistics/crude_oil_receipts.html, Accessed February 2018.

declining to import petroleum from other U.S. states and socially and environmentally progressive suppliers like Canada. None of California's spending on imported foreign oil supplies will help reduce emissions in the U.S. or Canada, nor is it likely to be spent on reducing the risks of climate change by the state's overseas suppliers.

3. Inefficient California climate spending priorities.

The absence of real-world assessments of GHG policy costs and effectiveness means that the Scoping Plan, and other state climate programs, cannot meaningfully distinguish between efforts that would most likely result in the greatest amount of in-state or global GHG emission reductions from those for which potential effects are difficult to reliably measure, let alone compare with other options. The absence of transparency and effectiveness analyses has also precluded any meaningful disclosure of cost-effectiveness, or consumer costs, in California's GHG reduction efforts.

U.S. GHG reductions, for example, have largely occurred from using a cleaner power generation source, natural gas, in place of coal. The approximate GHG and other emissions from these two fuel sources can be estimated with reasonable precision, and the costs are known from the prices of the fuels and the power supplied to end users. In Illinois, for example, several coal power plants formerly owned by Midwest Generation were purchased by a new owner, which retrofitted the facilities at a cost of \$567 million to use natural gas. The upgraded facilities reduced net emissions by 16 MMTCO₂e per year at a cost of about \$35.4 per ton.¹¹⁸ The costs and effectiveness of many Scoping Plan measures cannot be evaluated

with any reasonably accurate level of precision, and some clearly reflect political, rather than climate change mitigation priorities.

The Scoping Plan specifically includes the completion of California's high speed rail (HSR) project between the Bay Area and greater Los Angeles as one of the many transportation-related measures deemed necessary to reduce GHG emissions. According to the HSR program itself, however, when built, and assuming all of the relatively optimistic projections about future ridership and avoided automobile and aircraft use are accurate, the facility's primary proponents claim it will eventually "save" 1 MMTCO₂e per year at some point in the future.¹¹⁹ Even if a 1 MMTCO₂e reduction was achieved, the project would contribute to less than 0.55% of the total net reduction the state is required to meet during 2015-2030.

The costs of the HSR jumped to over \$77 billion in early 2018, and program officials further indicate that the true cost may be more than \$98 billion.¹²⁰ If the projected GHG emission benefits of the HSR project are fully realized, the cost per ton of GHG emissions reduced by HSR would range from \$77,000 to \$98,000. According to the U.S. EPA, a conventional hybrid car, such as a Prius, generates 2.3 metric tons fewer GHG emissions per year than a gasoline powered car.¹²¹ The average price of a Prius in southern California was about \$24,000 in February 2018.¹²² California could achieve the same annual 1 MMTCO₂e "savings" as claimed for the HSR project by replacing about 425,000 gasoline cars with the same number of Prius vehicles at a cost of approximately \$10.4 billion, or \$10,400 per metric ton. A hybrid car give-away policy would be seven to nine times less costly than the maximum reductions claimed for the HSR.

California's Scoping Plan, and its climate leadership efforts more generally, dramatically contrast with the careful technological, economic, and effectiveness analyses required for new air pollution reduction plans and regulations adopted under the federal Clean Air Act.¹²³ The Act requires regulators to develop plans to achieve healthy air quality in relation to six designated pollutants, and to rank potential regulatory pollution reduction mandates by cost-effectiveness as well as other factors. As discussed above (see Tables 2.7 and 2.8), the EPA has published several reports documenting the success of the Clean Air Act in reducing emissions from industrial sources like factories and power plants, as well vehicles and other mobile sources, including the removal of 99% of vehicle pollutant emissions since the 1960s. Although these regulations did not target GHG reductions, the "co-benefit" of emission tailpipe emission mandates also resulted in GHG emission reductions even as gross domestic product, population, and VMT, all rose.

Although the Clean Air Act provides a proven template of regulatory success in reducing air pollutants from vehicles, the Scoping Plan as well as other climate regulatory proposals demand that Californians drive less – reduce VMT – even if all future cars are non-emission EVs. The Scoping Plan also reaches much further into the lives of ordinary Californians by prescribing what kind of housing should be built in the future (higher density, near public transit, smaller units), even though all but 15 of the 50 most dense metropolitan regions in the nation are already in California. The Los Angeles, San Francisco, and San Jose regions are the three most dense metropolitan areas in the nation (with the New York/Newark metropolitan area coming in at the fifth most dense).¹²⁴

The absence of any transparent or comprehensive effectiveness, cost, or equity analytical criteria in the Scoping Plan is of

particular concern from a civil rights and social equity perspective. For example, the extent to which density actually affects emissions depends on several factors difficult to verify and monitor under real world conditions. Greater density may seem to offer opportunities to reduce vehicular use and travel distances, but it can also greatly increase rents and property prices, as well as traffic congestion that increases the duration of vehicular trips with a corresponding increase in vehicular emissions.¹²⁵ In response, density can spur development and growth outside of urban areas, or population shifts to less efficient, but more affordable states entirely. One of the most extensive studies of densification and GHG emissions to date concluded that, due to these constraints, "an entirely new approach of highly tailored, community- scale carbon management is urgently needed:"

As a policy measure to reduce GHG emissions, increasing population density appears to have severe limitations and unexpected trade-offs. In suburbs, we find more population- dense suburbs actually have noticeably higher HCF, largely because of income effects. Population density does correlate with lower HCF when controlling for income and household size; however, in practice population density measures may have little control over income of residents. Increasing rents would also likely further contribute to pressures to suburbanize the suburbs, leading to a possible net increase in emissions. As a policy measure for urban cores, any such strategy should consider the larger impact on surrounding areas, not just the residents of population dense communities themselves. The relationship is also log-linear, with a 10-fold increase in population density yielding only a 25% decrease in HCF. Generally, we find no evidence for net

*GHG benefits of population density in urban cores or suburbs when considering effects on entire metropolitan areas.*¹²⁶

In recent years, new housing units built near transit stations are also almost entirely relatively mid-rise and high-rise rental units. As discussed in Section 3, due to construction costs, rents for these units are at least \$3000 per month in the state's most urbanized areas – and are “affordable” only to households making in excess of \$100,000 per year. Since average median incomes in such areas is considerably lower than \$100,000 per household, the higher density rental unit housing maximized under the Scoping Plan is inherently unaffordable to most working families.

Notwithstanding these considerations, California remains committed to density and reducing VMTs as a core element of the state's climate policies. One widely cited study, for example, proposes to replace tens to hundreds of thousands of existing structures, including occupied homes, with 1.9 million new housing units on just 4% of the state's land, all within existing infill areas.¹²⁷ The study concedes that this approach would displace households in affordable housing and that new affordable housing programs would be required to address the high cost of new units. The construction of 1.9 million homes solely in heavily urbanized infill locations is estimated to “save” 1.79 MMTCO₂e compared to a non-infill scenario. In practice, even these reductions are suspect because housing costs and lack of home choices are already driving people from the state, and legal challenges to infill projects, including threatened and filed CEQA lawsuits, reduce the likelihood that the study's target

scenario will ever be accomplished as planned. If the projected “savings” in fact occur, the restructuring of statewide housing to limit the choices, sizes and locations of new housing would amount to less than 1% of the total GHG reductions required by the Scoping Plan for 2030 (i.e., approximately 182 MMTCO₂e from 2015 levels).

The HSR, VMT and mobility reduction, and densification elements of the state's climate change strategy are extraordinarily costly measures and require substantial state intrusion into and control of the daily lives of California residents. The GHG reduction benefits that would accrue from these measures are difficult to estimate, let alone verify. The contrast with potentially more effective, and significantly less costly regional GHG reduction efforts, as discussed below, is relatively stark.

4. Omitted in-state GHG emissions

The Scoping Plan, and CARB's emission inventory for the state, also excludes quantified GHG emissions even within the state from certain sectors, such as the significant amount of in-state emissions from commercial aviation and from wildfires fueled in part by decades of forest mismanagement. Each of these emissions sources is far larger than many of the sectors – including housing and VMT - that are minutely regulated under the Scoping Plan, and each contributes to global emissions even if they are treated as “off the book” by state regulators.

California uses 20% of the nation's total jet fuel.¹²⁸ Yet, in 2015 the CARB included just 4.2 MMTCO₂e of 44.4 MMTCO₂e per year of commercial aviation emissions in the state's total emissions inventory.¹²⁹ While this

approach reflects a similar ambiguity in other national GHG emission accounts, it leaves virtually untouched an emission source that amounts to 10% of the state's total reported GHG emissions. Airline emissions are also believed to have a net global warming potential that is 2-4 times as great as the actual volume of GHGs emitted during flights due to the altitude at which the emissions occur, and the possibility that they reduce heat transfers out of the atmosphere, particularly at night.¹³⁰ The most recent research indicates that aircraft emissions should be considered to have a global warming "multiplier" of about twice the volume of GHG emissions.¹³¹ Consequently, the global warming effect of jet fuel consumption from California supplies could range from about 80 MMTCO_{2e} assuming a 2.0 multiplier effect, and possibly as much as 160 MMTCO_{2e} per year if the higher 4.0 multiplier eventually proves to be more applicable.

The absence of any attempt to reduce passenger miles traveled, and therefore aircraft emissions, starkly contrasts with the Scoping Plan's numerous measures designed to reduce vehicle miles traveled. There are already proven technologies that reduce GHG emissions from vehicle travel, however, and the link between VMT and such emissions will continue to fall as cleaner vehicles, including EVs powered by potentially 100% non-fossil fuel electrical sources, continue to be deployed. There is no known technology that can reduce aircraft emissions per flight to any comparable degree. Electric motors do not produce enough power to fly a commercial airplane, and powering aircraft with biofuels has been estimated to require nearly 20% of all of the world's available farmland.¹³²

The Scoping Plan VMT reduction measures are inherently regressive because they impose

fixed fuel, vehicle and related housing costs on all residents irrespective of income. As indicated by the profile of frequent fliers published by United Airlines, for example, air travel is largely a luxury good for wealthier patrons. Individuals enrolled in United's basic frequent flyer program (Mileage Plus) and premier Mileage Plus program are 3.5 times more likely to own a home worth in excess of \$500,000, 3.7 to 5 times more likely to earn over \$200,000 per year, and 3.2 to 3.6 times more likely to have a household net worth of over \$1 million than the U.S. average.¹³³

Yet, the Scoping Plan contains no measures or requirements that would reduce commercial aviation miles, even to the extent of limiting aircraft use by state employees and contractors, which California officials directly control. The ongoing and documented reduction in GHG emissions from vehicular travel may well make VMT reduction policies increasingly irrelevant, but a significant cutback in jet fuel consumption would result in a direct and otherwise unattainable reduction in GHG emissions from commercial aviation. If California reduced jet fuel consumption in the state by 15%, for example, commercial aircraft emissions would fall by over 6 MMTCO_{2e}, and the avoided global warming potential of these emissions would be reduced by at least 2 times. Even without considering aviation emission multiplier effects, a cutback of 6 MMTCO_{2e} would be more than double the emission reductions claimed by project proponents for both the HSR and from the infill development of 1.9 million housing units combined (2.79 MMTCO_{2e}).

A second major omission is the GHG emissions attributed to annual forest fires in California, many of which burn hotter, and release more GHG tonnage per acre, than

if they were managed in a more efficient, sensible manner consistent with pre-industrial conditions. About 33% of the state is forested, and for decades pre-European settlement growth patterns have been altered to result in a much more dense, overgrown and less fire-resilient mix of trees and vegetation than would occur under natural circumstances. Mature trees are stunted in growth, less healthy and more susceptible to insect infestation that has killed well over 100 million trees. The extent of shade tolerant trees and lower lying vegetation with much less ability to survive fires has greatly increased throughout the forests. Consequently, the amount of carbon dioxide removed from the atmosphere and stored in living forest vegetation has, despite the overgrown nature of the forest lands, been reduced by as much as 25% over the last 150 years.¹³⁴

The carbon dioxide sequestered in California forests, moreover, is released more rapidly and causes greater long-term emissions than under natural conditions. The U.S. Forest Service has estimated that during 2013-2015, “wildfires on federal lands alone have consistently amounted to around 20-25 ... MMTCO₂e... each year. Worse still, in many post-burn areas, decay rates are so much greater than new growth that “post-fire emissions in subsequent years could rival or even exceed the direct emissions of the initial wildfire event.”¹³⁵ These findings are consistent with a 2005 analysis of California fire emissions which found that due to the overgrown nature of poorly managed forests in the state, direct emissions average about 63 tons of GHG per acre, and up to three times more GHG emissions would be released over the next 50 years as unburnt, but damaged wood and other plant material decay. Overall, the study estimated that 144,000 acres burned by just four

wildfires will eventually emit 38 MMTCO₂e, or about 262 tons per acre from direct combustion and multi-year decay.¹³⁶ Finally, a 2018 Little Hoover Commission Report found that wildfires during 2001-2010 directly released about 120 MMTCO₂e from state forests, and that post-fire emissions could be five times greater than the amounts released during the fire itself.¹³⁷ By any measure, wildfires that burn unnaturally hot in mismanaged, over-fueled state forests are producing uncounted GHG emissions in amounts that largely counteract much of the state’s progress in other areas.

Table 2.15 provides an estimate of the GHG emissions potentially associated with the annual average wildfire acreage that has burned in California during 2007-2016 reported for the state fire response agency, CalFIRE, and subject to response by federal firefighting agencies. The estimates are based on an average of 60 tons of GHG emissions per acre burned, plus another five times the initial burn amount due to long-term decay. If the reported emissions from in-state fires and subsequent burn area emissions are accurate, the mismanagement of California forests could account for as much as 255 MMTCO₂e of fire related emissions per year (although the post-fire burn emissions would occur over a period of several years after the fires occurred). The state GHG emissions subject to the Scoping Plan include none of these fire-related emissions, despite the fact they could amount to nearly 60% of the entire state emissions inventory reported by CARB for 2015.

The Scoping Plan contains no specific objectives for controlling and reducing wildfire-related GHG emissions, and does not identify either measures or funding for addressing the possibility that forest resources, far from absorbing net GHGs as in most locations, may be a net contributor to state emissions

without major policy and practical reforms. The plan refers to the development of a “Forest Carbon Plan” but as noted by the Little Hoover commission does not identify any means for ensuring that the plan, which has yet to be adopted, will actually be implemented. Among other challenges, restoring California’s forests to health and to function as net carbon sink for GHG emissions include the following:

- Removing over 100 million dead trees from insect and drought that are now decaying in place and emitting rather than sequestering GHGs;
- Greatly increasing the pace and acreage of state, federal and private forests subject to treatment to reduce excess undergrowth, encourage large, healthy, fire resistant tree growth, and reducing fuel for future fires;
- Finding solutions to permit restrictions and environmental opposition to using controlled fires to treat forests, which can affect air quality and habitats, but is essential for long-term forest health and increased carbon sequestration capacity; and
- Identifying, incentivizing with permit

streamlining and/or subsidies the use of removed vegetation for economically beneficial purposes, such as structural wood products, lumber products, and biomass power generation, many of which have been in decline due to regulatory constraints and environmental opposition.¹³⁸

Unlike many Scoping Plan policies, the implementation of forest management reforms will produce immediate and long-term GHG reductions from a resource that cannot be relocated or “shuffled” in other states and countries. It also has the potential to create industrial and related employment opportunities in some of the state’s most impoverished inland counties, providing new opportunities for upward mobility for residents not linked with the coastal, and predominately Bay Area based technology sectors. The primary obstacles to achieving forest management reforms and related GHG emissions benefits are political will and funding. Yet, even if 10% of the funding for the HSR project, or about \$6.4 billion, was redirected to forest treatment, maintenance and the construction of biomass wood product and energy

Table 2.15

ESTIMATED FIRE-RELATED DIRECT AND LONG TERM GHG EMISSIONS BASED ON 2007–2016 AVERAGE ANNUAL WILDFIRE ACREAGE SUBJECT TO RESPONSE BY CALFIRE AND FEDERAL FIREFIGHTING AGENCIES

	2007-2016
Average Annual CalFIRE and Federal Wildfire Acreage	709,929
Direct Emissions, 60 tons GHG emissions per acre	42,595,758
Long term post-burn emissions, 5 times direct burn GHG emission tonnage	212,978,790
Total GHG emissions from annual average wildfires in state (tons)	255,574,548

Sources: Average Annual CalFIRE and Federal Firefighting Agency Wildfire Acreage calculated from CalFIRE, California Wildfires and Acres for all Jurisdictions (for the years 2007-2016), http://cdfdata.fire.ca.gov/pub/cdf/images/incidentstatevents_269.pdf; Direct emissions estimates per acre from Thomas M. Binnicker, Greenhouse Gas Emissions From Four California Wildfires: Opportunities To Prevent And Reverse Environmental And Climate Impact, FCEM Report No. 2, March 12, 2008, <http://www.idahoforests.org/img/pdf/FCEMReport2Final3-6-08.pdf>; long term indirect emissions potential from Little Hoover Commission, Fire on the Mountain: Rethinking Forest Management in the Sierra Nevada, Report #242, February 2018, page 41 <https://static1.squarespace.com/static/55dc9bade4b05820bf02d414/t/5a78bfd8f9619af89bfbfd603/1517862883845/Little+Hoover+Commission+Report+on+Forest+Health.pdf>; accessed February 2018.

facilities outlined in the Forest Carbon Plan and the Little Hoover Report would produce many times the GHG emission benefits claimed for the HSR project.

D. THE NEED TO REFOCUS CALIFORNIA ON REGIONAL OBJECTIVES

The Scoping Plan is a fundamentally inward-looking document that requires minute and highly intrusive regulation of Californians to achieve, in many cases, very small GHG benefits measured against even state goals, let alone the national and international emissions that will ultimately determine future global temperatures. Much more significant reductions already have, and can continue to be made at a national and North American level if California would only focus on these opportunities. And the state would also avoid, however unintentionally, pursuing climate policies that foster the economic power of some of the most repressive and exploitative nations in the world. The following section summarizes how state policies have badly distorted the California economy in ways that also harm its most vulnerable and historically underprivileged populations even if the state appears successful at the macroeconomic level of abstraction used in the Scoping Plan.

III. THE SOCIAL AND ECONOMIC CONSEQUENCES OF CLIMATE UNILATERALISM

According to CARB, economic projections show that in 2030, “the costs of transitioning to this lower carbon economy are small

[and]...the California economy, employment, and personal income will continue to grow as California businesses and consumers make clean energy investments and improve efficiency and productivity to reduce energy costs.” In addition, the economic projections do “not capture the impact of new technologies that may shift the economy and California in unanticipated ways or benefits related to changes in air pollution and improvements to human health, avoided environmental damages, and positive impacts to natural and working lands.” Consequently the economic impact analyses “likely underestimate the benefits of shifting to a clean energy economy.”¹³⁹

Since the Global Warming Solutions Act became effective in 2007, California climate policies and related regulatory programs, including CEQA, have contributed to significantly higher costs for energy, housing, transportation, food and other basic necessities in the state. These costs are highly regressive because they disproportionately burden residents and households with lower incomes and wealth. As required by law, CARB provided an estimate of the Scoping Plan’s economic impacts. Noting that “since the launch of many of the state’s major climate programs... economic growth in California has consistently outpaced economic growth in the rest of the country,”¹⁴⁰ the analysis was conducted solely at a macroeconomic level. Based on the results, the Scoping Plan asserts that “the costs of transitioning to [a] lower carbon economy are small” and that “the California economy, employment, and personal income will continue to grow” in the future. Notably absent is any discussion of how the state’s existing costs, let alone additional burdens, severely harm lower-income and historically disadvantaged communities and households.

In September 2017, for example, the U.S. Census Bureau published an updated analysis of the “supplemental measure of poverty” (SPM) in the United States, which responds to concerns about the accuracy of official poverty estimates using fixed income thresholds throughout the nation irrespective of local costs of living.¹⁴¹ The SPM was first published in 2011 in accordance with recommendations from a National Academy of Sciences (NAS) panel in 1995 and an interagency working group formed in 2009. In addition to periodic SPM updates, the Census Bureau also publishes and provides an online tool for estimating poverty rates using certain methodologies recommended by the NAS (NAS-based estimates).¹⁴² Unlike the official poverty measure, both the SPM and the NAS-based estimates take account of regional cost disparities.

The most recent SPM report was widely reported, often with surprise, because it showed that California, despite having what the Scoping Plan describes as the world’s “6th largest economy,” also has by far the nation’s largest population in poverty and highest overall poverty rate. As shown in Table 3.1, the NAS-based poverty estimates show that California poverty is even worse than indicated in the SPM report. Table 3.1 also shows the official, SPM and NAS-based poverty estimates for the United States outside of California, and for Texas, which, like California, is a large minority-majority state.

The SPM and NAS-Based results show that, due to the state’s extremely high costs of living, the number of people in poverty is significantly higher than indicated by using the fixed official rate without adjusting for geographic disparities in housing, energy and other expenses. In contrast, the official, SPM and NAS-Based estimates for the U.S. outside of California, and for Texas, are relatively unaffected by costs of living. As shown in Figure 3.1, when the state’s

higher relative costs are taken into account, the number of Californians in poverty rises by nearly 50% (SPM) to 65% (NAS-based estimate) from the official poverty estimate. The estimates vary by only about 10% for the U.S. excluding California, and by only 6% for Texas.

The poverty data show that California has a very substantial, if not crisis-level poverty problem when cost of living factors are included. Costs of living have a much lower impact in the rest of the county, and in the case of Texas for example has virtually no effect on poverty rates despite similar demographics. The cost of living in California, for such fundamental necessities as housing, transportation and electricity, is simply dramatically higher than the national average. Under either the SPM or NAS-based estimates, the number of state residents in poverty is about 8 to 9 million, roughly the population of Austria or Switzerland. There is ample evidence that the SPM and NAS-based

Table 3.1

OFFICIAL, SPM AND NAS-BASED ESTIMATES OF PEOPLE LIVING IN POVERTY FOR CALIFORNIA, US EXCLUDING CALIFORNIA, AND TEXAS, 2016 (2014–2016 average for SPM)

	Official Estimate	Supplemental (SPM) Estimate	NAS-Based Estimate
California	5,435,000	7,955,000	8,975,000
United States Excl. California	35,181,000	38,793,000	38,243,000
Texas	3,812,000	4,017,000	3,780,000

Sources: CPS Table Creator, <https://www.census.gov/cps/data/cpsstablecreator.html> for official and NAS-based estimated, Consumer Expenditure Survey (CE)-based threshold and NAS income less medical out of pocket expenditure (see <https://www.census.gov/cps/data/povthresholds.html>) and geographic price difference adjustment); Table A-5, <https://www.census.gov/library/publications/2017/demo/p60-261.html>, accessed February 2018

measures likely understate the true magnitude of lower-income distress in California:

- In 2015, the United Ways of California published an influential study demonstrating that, using a real cost of living measure (real cost measure) that includes additional basic needs not measured in the SPM or NAS methodology such as childcare for typical families consisting of two working adults or a single parent, more than 30% of all Californians “do not have sufficient income

to meet their basic costs of living.” Struggling households in the state were found to include 51% of all Latino households, 40% of African American households, 28% of all Asian American households, and 20% of all white households.¹⁴³

- In 2016, the U.S. Census Bureau published an updated analysis of income inequality in the U.S. which found that California was the nation’s second most unequal state, behind only New York. If it were an independent

Figure 3.1

CHANGE IN SPM AND NAS-BASED ESTIMATES OF NUMBER OF PEOPLE IN POVERTY RELATIVE TO OFFICIAL ESTIMATE, 2016 (2014–2016 average for SPM)



Sources: see Table 3.1

nation, California would rank as the 17th most unequal nation of 158 countries analyzed by the World Bank, slightly below the level of inequality in the Congo, and just above Guatemala.¹⁴⁴

- The Public Policy Institute of California (PPIC) has developed a poverty measure for California that accounts for cost of living factors and results in approximately the same estimate as the SPM report. The PPIC also found that nearly 40% of Californians were either poor or near-poor, and that the poorest segment of the population was much larger (about 5.5%) than previously estimated.¹⁴⁵

California's existing disproportionate cost burdens indicated by the SPM and NAS-based results are also consistent with other reported estimates. A national survey of housing, food, medical and other costs conducted by the Council for Community & Economic Research showed that in 2017, California was the second most expensive state in the nation, just after Hawaii, and had a cost index about 41% higher than average.¹⁴⁶ In 2016, seven of the ten most expensive regions in the country in an analysis of 349 regions developed by the Census Bureau for the SPM poverty thresholds were located in California. The top two were the San Jose-Sunnyvale-Santa Clara and San Francisco-Oakland-Hayward metropolitan areas, followed by Santa Cruz-Watsonville (4th) Oxnard-Thousand Oaks-Ventura (6th), Los Angeles-Long Beach-Anaheim (7th), Santa Maria-Santa Barbara (9th) and San Diego-Carlsbad (10th). All had relative cost index values ranging from 50% (San Diego-Carlsbad) to 87% (San Jose-Sunnyvale-Santa Clara) above the national average.¹⁴⁷ Census Bureau data also shows that California accounts for five of the ten metropolitan regions with the lowest homeownership rates of the largest 75 regions in the country, with Fresno and Los Angeles-Long Beach-Anaheim ranked first and second followed by San Jose-Sunnyvale-Santa Clara

(4th), San Francisco-Oakland-Hayward (8th) and San Diego-Carlsbad (9th).¹⁴⁸

The Scoping Plan economic impact analysis apparently assumes that the state's recent pattern of development, including very low home ownership rates, and above average costs for almost all necessities including electricity and transportation fuel, represents a desirable economic and social outcome. The possibility that GHG emissions could be reduced in a less regressive fashion, which causes less pain or even helps generate positive economic outcomes to the nearly 9 million Californians living in poverty, is not even raised in the Scoping Plan. Suggestions for greater transparency, or respect for more traditional progressive values like civil rights and consumer protection, have been dismissed by CARB in relation to the Scoping Plan.¹⁴⁹

Yet, as discussed in Section 2, many other states have reduced GHG emissions to a much greater extent, and at far lower cost, than incurred by California since 2007. Between 2007-2016, Ohio, Pennsylvania, Georgia and Indiana, for example, cut GHG emissions by more than the total reduction California must achieve to meet the state's 2030 goals. Collectively these four states have about the same population as California and a combined gross product of \$2.25 trillion in 2016 (about the same as the 8th largest economy in the world). In 2016 these four states had 560,000 fewer people in poverty (SPM estimate), 865,000 more manufacturing jobs (including 205,000 new manufacturing jobs created from 2010 to 2017 compared with just 60,000 in California), and 1.46 million fewer adults over age 25 with less than a high school diploma than in California.¹⁵⁰ The median home value was just 32% of the median value in California, and median rents were 40% lower than in California. About 66% of all households in the four states owned their own home compared with just 54% in California. Just 36% of all renters in

the four states spent more than 30% of their incomes on housing, compared with nearly 50% in California.¹⁵¹ These data indicate that much more substantial GHG reductions can be achieved by populations with comparable size and wealth as California, but with lower energy costs to consumers, an economic base that supports hundreds of thousands more manufacturing jobs which provide a bridge to middle-class jobs and mobility for non-college-educated workers,¹⁵² much greater opportunities to own a home, and far lower housing cost burdens. The fact that California has reduced emissions by much less than other states, and with greater harm to middle- and lower-income, minority, and less educated communities, is not addressed in the Scoping Plan and is not recognized by most climate policy leaders.

A full accounting of the harm that millions of Californians have experienced since 2007, which included both a deep recession and then a more recent, but highly unequal, period of economic growth, is beyond the scope of this paper. The following sections discuss certain of the most significant adverse consequences that have occurred, and that are likely to intensify, unless California revises the state's climate change policies to address disparate impacts, improve cost efficiency, and move beyond the unilateral approach that is being abandoned by even the most fervent supporters of the Paris Agreement.

A. CALIFORNIA OUTSIDE OF THE BAY AREA

California's aggregate growth since 2007 even as housing, energy and other costs rose in response to climate and related policies, conceals the fact that almost all of the state's real economic achievement occurred in the five counties in the San Francisco Bay Area. The Bay Area has about 16% of the state's population.

During 1997-2007, California employment grew much more rapidly, and was distributed to a much greater extent outside of the Bay Area, than during 2007-2017. These results are reflected in both the Bureau of Labor Statistics (BLS) estimates and the Current Employment Statistics (CES) and estimates after which are based on payroll surveys and do not include agricultural or self-employment data (Table 3.2), and in the BLS Local Area Local Area Unemployment Statistics (LAUS), which includes estimates of agricultural and self-employed activity (Table 3.3).

Tables 3.2 and 3.3 show that, since 2007, the Bay Area accounted for 36% (CES) to 46% (LAUS) of the state's total employment growth. Economic conditions and employment growth in the rest of state, which includes 84% of all California residents, markedly deteriorated compared with 1997-2007.

Figure 3.2 compares the 1997-2007 and 2007-2017 employment growth rates in major geographical areas of California. The only portions of the state that grew more rapidly since 2007 were the San Francisco-Redwood City-South San Francisco and San Jose-Sunnyvale-Santa Clara regions. Employment growth in every other location declined in 2007-2017, including by about 50% in the Santa Rosa and Los-Angeles metropolitan areas to well over 70% in Anaheim-Santa Ana-Irvine (-74%), Riverside-San Bernardino-Ontario (-76%), Bakersfield (-82%) and Oxnard-Thousand Oaks-Ventura (-92%).

Figure 3.3 compares employment growth by major sector during 1997-2007 and 2007-2017 in the Bay Area and California excluding the Bay Area. Working class and middle class employment sectors either substantially declined in most of the state outside of the Bay Area, or grew far less rapidly than in 1997-2007. California lost a net of about 310,000 manufacturing, construction and financial services jobs during 2007-2017, nearly all

outside of the Bay Area. The state added 111,000 trade, transportation and utilities jobs since 2007, a sector that includes working and middle class warehousing, logistics and other employment, but this growth was far below the 394,000 new jobs created during the prior decade. Only the education and health services sector, which includes teachers and medical service employment that must be co-located with the regional population it serves, grew since 2007 in roughly the same manner as during 1997-2007.

During 1997-2007, the state added about 403,000 jobs in the information and professional and business services sectors, the employment groups that include higher-paying science, technology, engineering and management (STEM) jobs and the software publishing, motion picture and sound recording, traditional and internet broadcasting and data processing industries. About 368,000 (91%) of this growth occurred outside the Bay Area. Since 2007, the state added 353,000 jobs in the information and professional and business services sectors, 70% of which were in the Bay Area. The state outside the Bay Area lost information jobs (-24,000) compared with an increase of 81,000 in the Bay Area. About 162,000 (55%) of the state's total of 296,000 new professional and business services jobs were located in the Bay Area. As discussed above, the CES data is based on payroll surveys and does not include self-employed and non-payroll contract work in professional and information sectors.

The 2007-2009 recession, which was more severe and prolonged than the 2001 recession, partially accounts for the lower amount and rate of total state employment growth during 2007-2017 compared with 1997-2007.¹⁵³ These factors do not, however, explain why employment growth in every sector in the entire state of California outside the Bay Area

Table 3.2

CALIFORNIA EXCLUDING THE BAY AREA AND BAY AREA EMPLOYMENT GROWTH, CES PROGRAM DATA 1997-2007 AND 2007-2017

	1997-2007	2007-2017
Employment Growth		
California Excl. Bay Area	2,170,825	859,217
Bay Area	90,250	488,692
California Total	2,261,075	1,347,908
Percent Employment Growth		
California Excl. Bay Area	20.9%	6.8%
Bay Area	3.2%	16.9%
California Total	17.1%	8.7%

Sources: Compiled from U.S. Bureau of Labor Statistics, Current Employment Statistics, 1997-2017, Total Nonfarm Employment, Annual Averages (Not Seasonally Adjusted), extracted from <https://www.bls.gov/data/>, accessed March 2018. The BLS CES aggregates data for the Bay Area in three regions, San Francisco-Redwood City-South San Francisco, San Jose-Sunnyvale-Santa Clara, and Oakland-Hayward-Berkeley.

fell substantially compared with the prior decade while Bay Area employment greatly increased. They also do not account for the substantial

Table 3.3

CALIFORNIA EXCLUDING THE BAY AREA AND BAY AREA EMPLOYMENT GROWTH, LAUS PROGRAM DATA 1997-2007 AND 2007-2017

	1997-2007	2007-2017
Employment Growth		
California Excl. Bay Area	2,151,944	592,252
Bay Area	(4,990)	524,985
California Total	2,146,954	1,117,237
Percent Employment Growth		
California Excl. Bay Area	17.9%	4.2%
Bay Area	-0.2%	18.9%
California Total	14.5%	6.6%

Sources: Compiled from U.S. Bureau of Labor Statistics, Local Area Unemployment Statistics 1997-2017, Annual Average Employed (Not Seasonally Adjusted), extracted from <https://www.bls.gov/data/>, accessed March 2018. The BLS LAUS aggregates data by county.

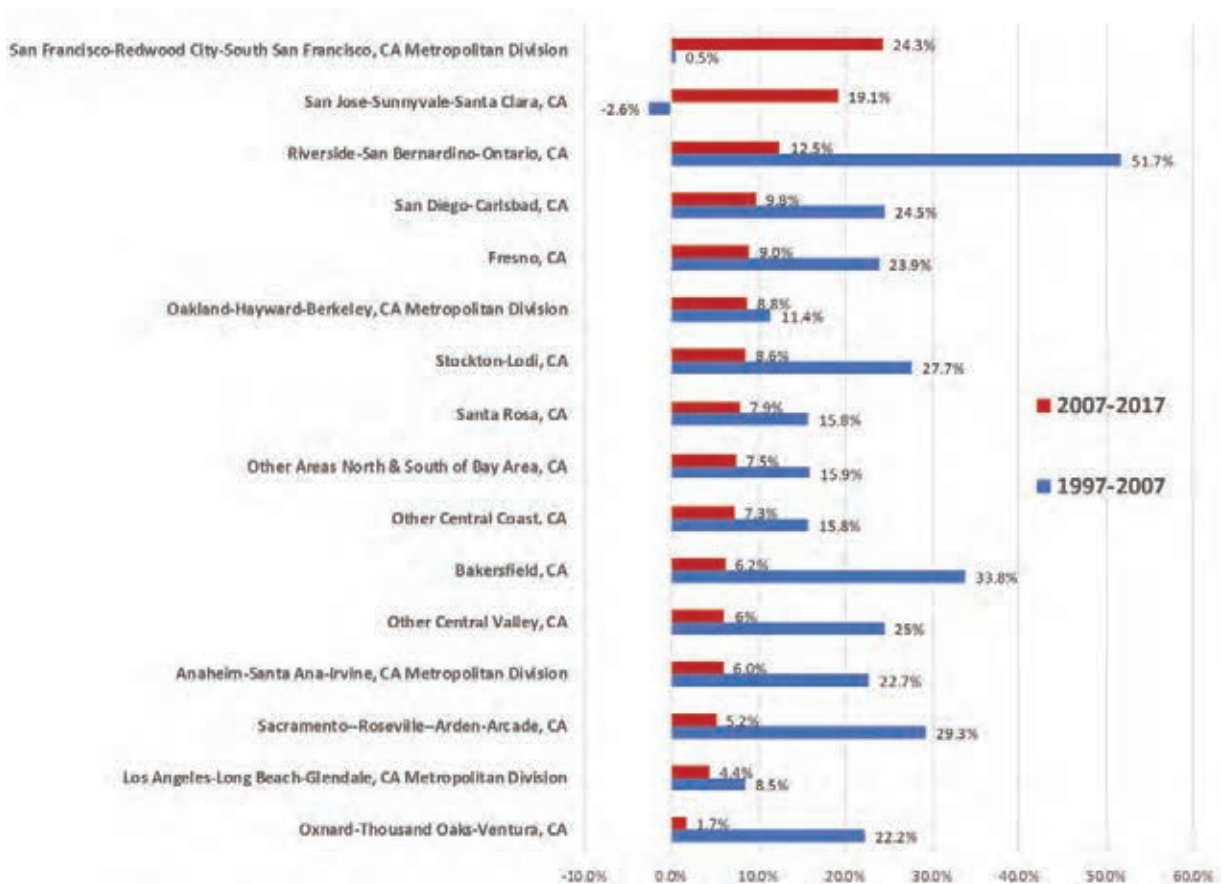
concentration of all new STEM, business and professional, and information jobs in the Bay Area (243,000 jobs) and the paltry net growth in these sectors (132,000 jobs) that occurred in the rest of the state since 2007. At least three factors appear to have allowed major Bay Area employers to compensate for California's significant cost of living disadvantages to a much greater extent than elsewhere.

First, social media and technology firms experienced what may be an unprecedented surge in market value and wealth during the last decade. In 2009, as the recession ended, Apple

and Google (Alphabet) had a combined market capitalization of about \$149 billion. Facebook was a private company three years away from going public. By the end of 2017, the market capitalization (stock price times shares issued) of just these three Bay Area firms rose to \$2.35 trillion, an amount roughly comparable with California's entire economic output. Apple and Google were the two largest public companies in the United States; Facebook was the fifth largest. The value of other Bay Area public companies, including Oracle, Applied Materials, Intel, Visa, Netflix, Ebay and Salesforce also

Figure 3.2

PERCENT EMPLOYMENT GROWTH BY CALIFORNIA REGION, 1997-2007 AND 2007-2017



Sources: See Table 3.2

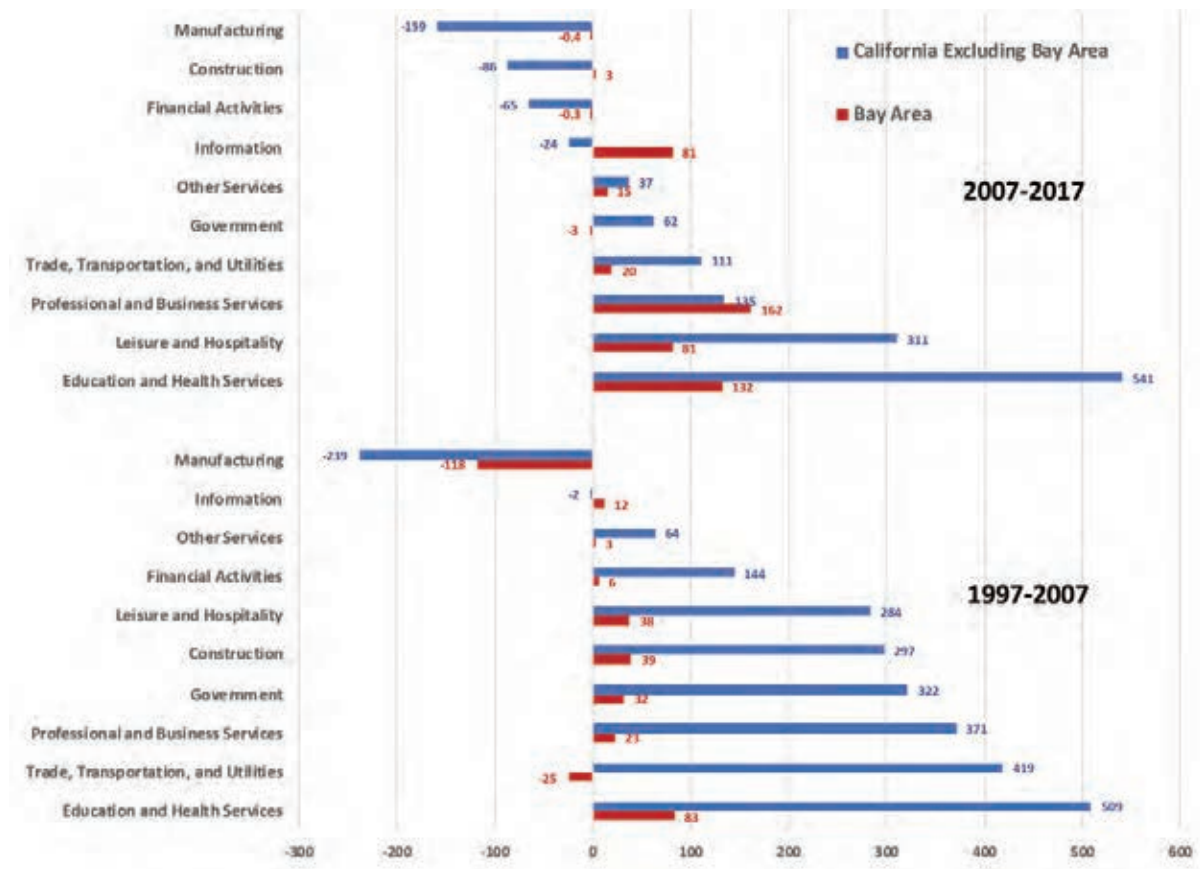
rose to about \$1 trillion by the end of 2017. Even Tesla, an electric vehicle manufacturer that has never made a profit, was valued at about \$60 billion in late 2017.¹⁵⁴ The concentration of stock-market driven wealth in the Bay Area over the last decade did not occur, and likely could not be replicated elsewhere in similar sectors given the dominant market positions of firms such as Google, Facebook and Apple.

A second factor is that Bay Area employers tend to employ younger, childless workers who have not yet developed significant family

or other obligations apart from pursuing a career. Young professionals who choose to defer families are likely to be more tolerant of the limited housing options and higher costs in California because they can eventually relocate to more affordable areas after a period of relatively high earnings. Younger workers are also able to live in nonfamily households similar to college living arrangements, such as homes or apartments jointly rented with other higher-wage roommates, to defray costs. The Bay Area's preference for young workers aged

Figure 3.3

EMPLOYMENT GROWTH BY PRIMARY ECONOMIC SECTOR, 1997–2007 AND 2007–2017 (1000s of new jobs)



Sources: See Table 3.2.

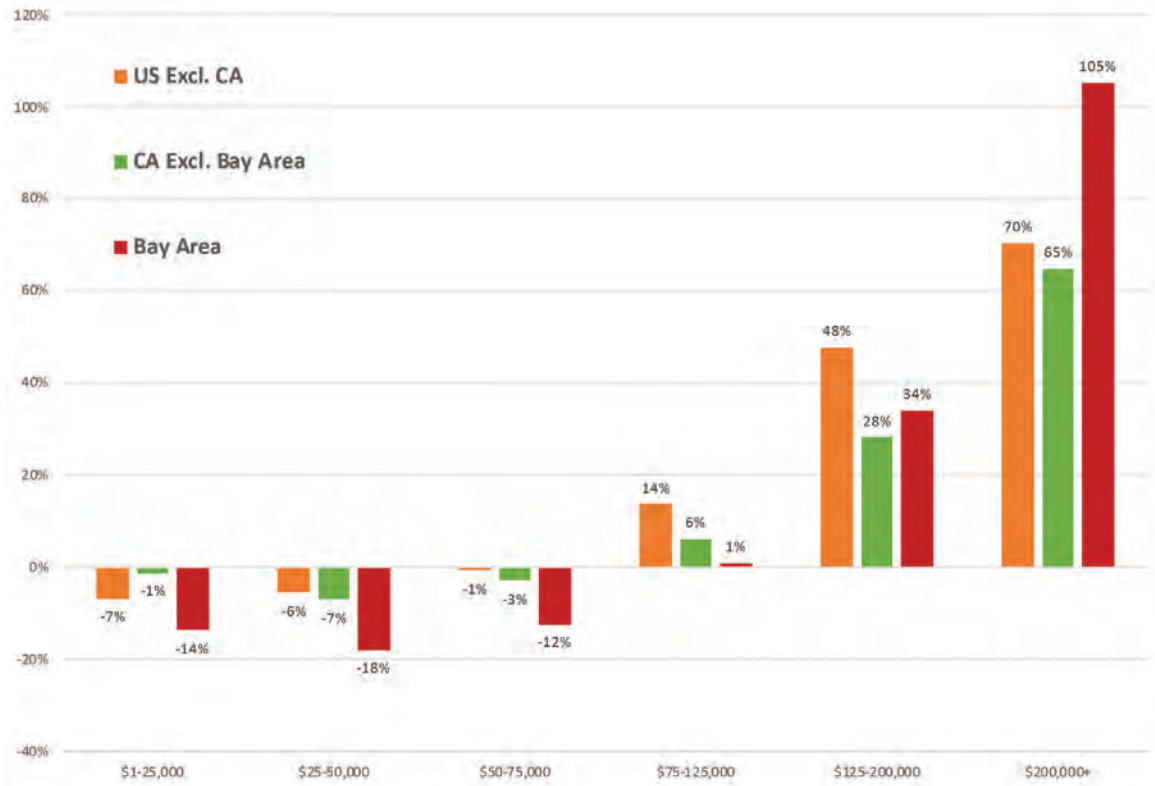
25-44 is so pronounced that Silicon Valley has been characterized as “one of the most ageist places in America” and a reported 226 age bias lawsuits have been filed against Bay Area technology firms since 2008.¹⁵⁵ In 2014, Facebook and Apple attracted significant media attention when they offered to freeze the eggs of their female employees and allow these workers to defer having children and focus on career development earlier in life. The policy was criticized for not accommodating workers with children,¹⁵⁶ but is consistent with the fact that birthrates in the Bay Area for women aged 15-50 are in fact much lower than the national average and in the rest of California.¹⁵⁷ Overall,

workers aged 25-44 comprise 31% of the Bay Area workforce compared with 28% in the rest of the state and 26% in the U.S. outside of California. During 2007-2016 the number of people 25-44 years old in the Bay Area rose by 216,000 (13%) compared with an increase of just 179,000 (2%) in the rest of California combined.¹⁵⁸

Finally, Bay Area employers appear to rely heavily on temporary, noncitizen guestworkers, almost of whom are from Asian countries, to a much greater extent than social media and technology firms in other regions. According to a December 2017 study published by the U.S. Bureau of Labor Statistics, noncitizens

Figure 3.4

PERCENT CHANGE IN HOUSEHOLDS BY INCOME LEVEL, BAY AREA, CALIFORNIA EXCLUDING THE BAY AREA, AND U.S. EXCLUDING CALIFORNIA, 2007–2016



Source: Compiled from 2007 and 2016 American Community Survey 1-Year Estimates, Table B19001 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

account for about 42% of the total number of computer scientists, systems analysts, network systems analysts, web developers, computer programmers, software developers, and computer hardware engineers employed in Silicon Valley compared with 24% in other U.S. technology centers.¹⁵⁹ Foreign guest workers on limited duration work visas are likely to be more tolerant of high housing and other costs of living in exchange for the opportunity to earn relatively high wages for a portion of their careers. Critics of the U.S. guest worker system suggest that temporary work visas expand the pool of job applicants, depress U.S. high technology wages, provide employers with more control over employees, and increase corporate profits.¹⁶⁰ Although accurate data on the number of authorized guestworkers in the Bay Area and other parts of the country is surprisingly unavailable,¹⁶¹ from 2007 to 2016 the population of noncitizen residents fell by over 429,000 in California outside of the Bay Area but rose by 75,000 in the Bay Area. The population of noncitizen Asian residents increased by 107,000 in the Bay Area (31% growth) compared with a net increase of just 3,000 (0.4%) in the rest of California.¹⁶² These data are consistent with the widespread perception that the Bay Area's technology sector employers heavily and disproportionately utilize temporary noncitizen guestworkers.¹⁶³

Outside of the Bay Area (where trillions of dollars of wealth accumulated since 2007), California employers and workers lacked comparable resources to compensate for the state's significantly higher costs of living. Figure 3.4 summarizes the change in household income (the combined income of all the people who occupy a housing unit, such as a house or apartment) during 2007-2016. Outside of the Bay Area (105% growth), growth in higher income California households (\$200,000 annual

income or more) was slower (65%) than in the rest of the nation (70%). Middle-income households (\$75,000-200,000) grew much more rapidly in the rest of the U.S. than in either the Bay Area or California excluding the Bay Area. This growth is consistent with the fact that high costs in California reduced the expansion of working and middle class jobs in the state.

The number of very low income households (\$1-25,000) remained virtually unchanged in California outside the Bay Area (-1%) but fell more rapidly in the rest of the U.S. (-7%) and in the Bay Area (-14%). The number of lower income households (\$25-75,000) fell much more rapidly in the Bay Area than in other locations. Overall, the number of poor households in California outside of the Bay Area declined more slowly while wealthier households grew less rapidly than in either the rest of the U.S. or in the Bay Area.

The adverse economic conditions in California outside of the Bay Area are reflected in the state's median income growth during 2007-2016. As shown in Figure 3.5, despite the state's much higher costs of living, median incomes in California outside the Bay Area were not significantly above median incomes in the rest of the U.S. Adjusted for inflation, real median incomes fell slightly in both the U.S. outside of California and in the state outside the Bay Area. Bay Area median incomes, however, grew much more substantially even when adjusted for inflation. Unlike the rest of California, the Bay Area possesses the economic resources to pay disproportionately high wages and was able to attract a workforce willing to adapt to limited housing and higher costs, at least for a portion of their careers.

Table 3.2 shows the net change in households in California and by major region from 2007-2016 by income. All of the net household growth in the Bay Area (179,000)

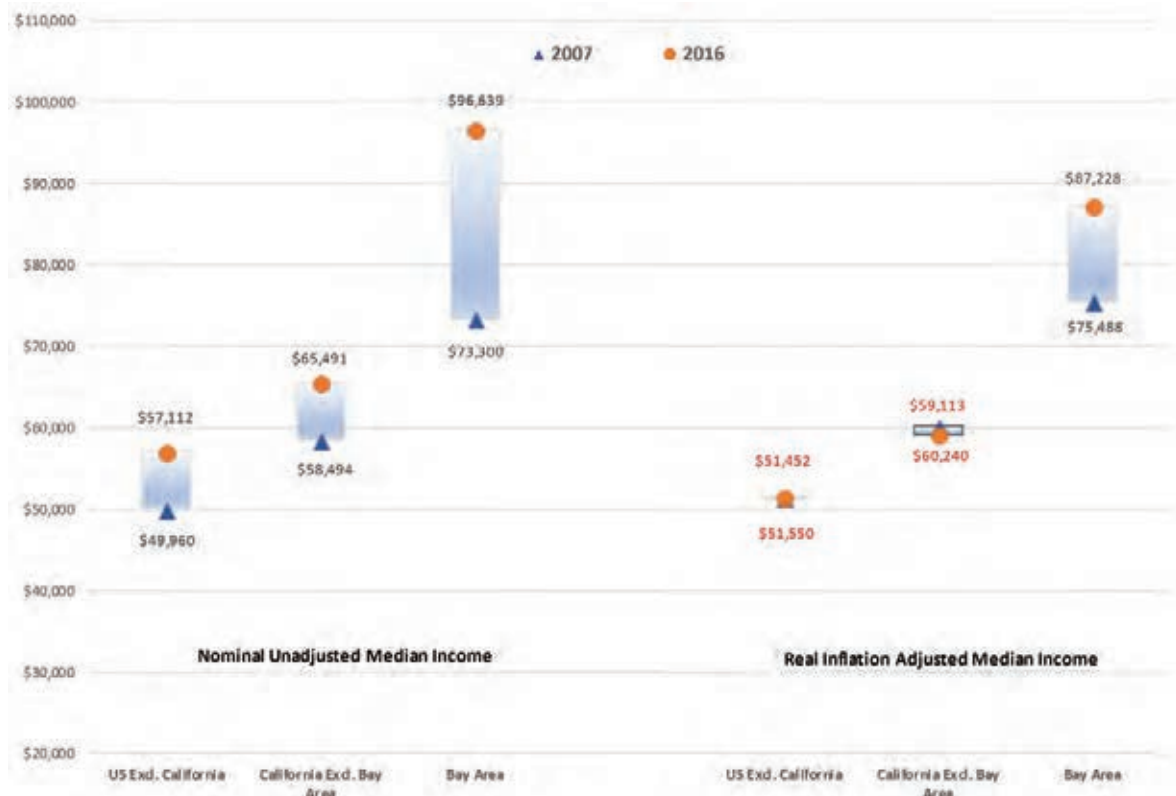
occurred in the income groups above \$100,000 per year. The Bay Area, in fact, accounted for about 41% (228,170) of the state's total increase in households earning \$200,000 or more (550,859). The number of lower income households (\$1-60,000) and in middle income ranges (\$60-100,000) fell by 166,000 in the Bay Area. In contrast, the number of very low income households (\$1-35,000) rose by nearly 61,000 in both the Riverside-San Bernardino and in the Sacramento, Kern, Fresno, San Joaquin and San Joaquin county

areas, significantly more than the combined increase of 50,000 in the number of households earning \$200,000 or more. The net growth in households earning over \$100,000 per year in Los Angeles County (231,000), the most populous region of the state with 26% of all California households, was substantially less than in the Bay Area (345,830) which has only 17% of all state households.

Table 3.3 summarizes the distribution of households within the state and each sub-region by income group in 2016. About 50% of all Bay Area households earned at least \$100,000

Figure 3.5

MEDIAN INCOME IN 2007 AND 2016, BAY AREA, CALIFORNIA EXCLUDING THE BAY AREA, AND U.S. EXCLUDING CALIFORNIA 2007-2016 (values in red=decrease from 2007 to 2016)



Source: Median income estimated from household income distributions for 2007 and 2016 American Community Survey 1-Year Estimates, Table B19001 series, accessed through <https://factfinder.census.gov/>, accessed February 2018 using the estimation methodology published by the California Department of Finance (see http://www.dof.ca.gov/Forecasting/Demographics/Census_Data_Center_Network/documents/How_to_Recalculate_a_Median.pdf) and adjusted for inflation using the Personal Consumption Expenditures deflator (2009=100) used by the California for Department of Finance for annual American Community Survey median income estimates for the state (see <http://www.dof.ca.gov/Forecasting/Economics/Indicators/Income/>).

Table 3.2

NET CHANGE IN NUMBER OF HOUSEHOLDS BY INCOME GROUP, STATE AND STATE SUBREGIONS, 2007–2016

	Total	\$1-\$35,000	\$35,000-\$60,000	\$60,000-\$100,000	\$100,000-\$200,000	More than \$200,000
State	743,506	-165,360	-149,983	-24,631	532,621	550,859
Bay Area	179,422	-70,609	-58,041	-37,758	117,660	228,170
Los Angeles County	123,686	-63,229	-49,303	4,868	127,364	103,986
San Diego and Orange Counties	120,808	-32,820	-22,995	2,684	86,369	87,570
Riverside-San Bernardino Counties	105,901	33,957	10,005	221	42,628	19,090
Sacramento, Kern, Fresno, San Joaquin Counties	104,969	26,991	-4,572	1,173	50,393	30,984
Other Counties	108,720	-59,650	-25,077	4,181	108,207	81,059

Source: 2007 and 2016 American Community Survey 1-Year Estimates, Table B19001 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

per year. No other region had a comparably large share of higher-income households, including the San Diego-Orange county area (38%), Los Angeles County (30%) Riverside-San Bernardino (26%) and the Sacramento, Kern, Fresno, San Joaquin county areas (24%). Just 31% of all Bay Area households earned \$60,000 or less, by far the lowest proportion in the state. Lower income households comprised 40% of all households in the San Diego-Orange county area, 49% in Los Angeles County, 51% in Riverside-San Bernardino, and 54% in the Sacramento, Kern, Fresno, San Joaquin county area. The percentage of total households earning more than \$200,000 was less than half of the Bay Area rate (20%) in Los Angeles County

(9%) and especially low in the Riverside-San Bernardino and the Sacramento, Kern, Fresno, San Joaquin county areas (5%).

Figure 3.6 summarizes the percentage of households by low, middle and high income category in 2016 for the U.S. excluding California, the Bay Area, and the rest of the state. In 2016, 41% of all California households outside of the Bay Area (4,469,833 households) compared with 27% in the Bay Area (428,452 households) earned less than \$50,000 per year. The proportion of low income households in the state excluding the Bay Area was almost exactly the same as in the U.S. outside of California (42%) despite the state’s substantially higher costs of living. About 73% of the Bay Area

Table 3.3

PERCENT OF HOUSEHOLDS BY INCOME GROUP STATE AND STATE SUBREGIONS, 2016

	Total	\$1-\$35,000	\$35,000-\$60,000	\$60,000-\$100,000	\$100,000-\$200,000	More than \$200,000
State	100%	26%	18%	22%	24%	10%
Bay Area	100%	18%	13%	19%	30%	20%
Los Angeles County	100%	30%	19%	21%	21%	9%
San Diego and Orange Counties	100%	22%	18%	23%	27%	11%
Riverside-San Bernardino Counties	100%	30%	21%	23%	21%	5%
Sacramento, Kern, Fresno, San Joaquin Counties	100%	33%	21%	22%	19%	5%
Other Counties	100%	28%	20%	23%	22%	8%

Source: 2016 American Community Survey 1-Year Estimates, Table B19001series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

households, however, earned more than \$50,000, and nearly 40% earned at least \$125,000 per year.

Outside the Bay Area, where unique conditions prevailed since 2007, California has a similar distribution of households by income group as in the rest of the U.S. But, as shown in Table 3.1, the state's cost of living are substantially above the national average. These costs, especially for housing and energy, increased since 2007, in part due to the effects of state climate change policies and other environmental and regulatory programs. Unsurprisingly, growth and economic opportunities for the portions of the state that

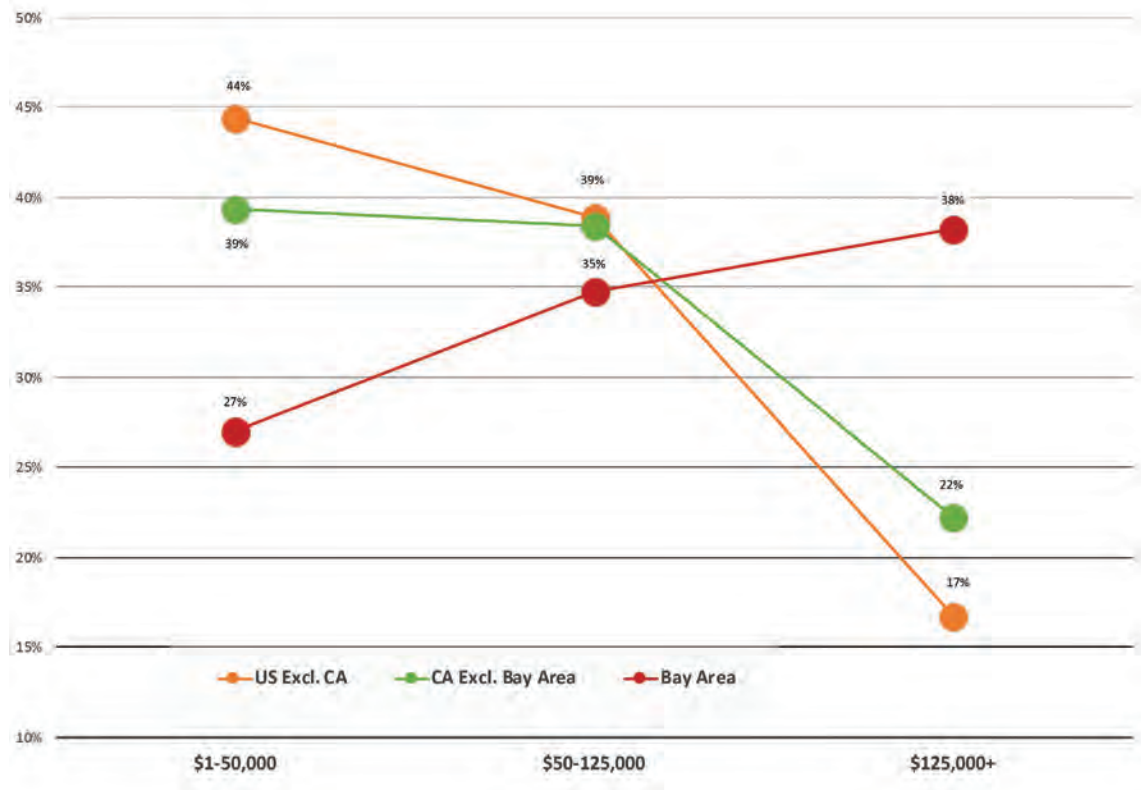
do not include cash-rich companies like Apple and Google were reduced in comparison with 1996-2007. The regressive policies implemented under the Scoping Plan will increase the already significant burdens facing the state's less affluent residents.

B. VULNERABLE AND DISADVANTAGED POPULATIONS

The Scoping Plan nowhere acknowledges or considers how California's cost of living burdens disproportionately harm economically vulnerable and historically disadvantaged

Figure 3.6

BAY AREA, CALIFORNIA EXCLUDING THE BAY AREA, AND U.S. EXCLUDING CALIFORNIA



Source: Compiled from 2007 and 2016 American Community Survey 1-Year Estimates, Table B19001 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

populations in the state, including Latinos (now the largest California ethnic group), African-American and black households, and residents who do not have college or graduate degrees. All of these groups are more adversely affected by the high housing, energy and other costs resulting from state climate and related policies that constrain new home construction, raise the cost of housing that can be built, and boost energy prices for both electricity consumption and transportation fuels well above the national average. These policies also constrain growth in sectors that traditionally provide middle income economic opportunities for workers without college degrees, such as manufacturing, goods management and logistics, and trade.

1. Background.

Table 3.4 summarizes the 2016 population in California, the Bay Area, and the state outside the Bay Area. In 2016, the Latino population was the largest ethnic group in the state (39%) followed by the white population (38%) and the Asian population (14%). In the Bay Area, however, the white population was significantly larger than any other group (36%) followed by the Asian population (29%).

Latinos comprised 42% of the state outside the Bay Area but just 23% of the population in the Bay Area. Only 10% of the total state Latino population was located in the Bay Area. Over 33% of the state’s Asian population (and 11% of the total U.S. Asian population) resided in the Bay Area.¹⁶⁴ Black residents accounted for 6% of the state’s population compared with 14% in the rest of the country. Overall, far fewer Latinos and Blacks reside in the Bay Area when compared to the rest of the state, and these groups have disproportionately migrated east to less costly areas of California where housing is more abundant and affordable – at a cost of grueling multi-hour commutes and gridlock.

Table 3.5 summarizes how the population changed by race and ethnicity since 2007 when the Global Warming Solution Act was enacted. During 2007-2016, the state’s white population fell by 5% (-797,520), a much greater decline than in the rest of the country (-0.2%), most likely due to out-migration from California to other states. The Bay Area black population also fell, and barely grew elsewhere in California, but increased by 10% in the rest of the U.S. Latino residents accounted for over 2 million of the state’s population growth, 89% of which

Table 3.4

TOTAL POPULATION BY RACE AND ETHNICITY, BAY AREA, CALIFORNIA EXCLUDING THE BAY AREA, AND U.S. EXCLUDING CALIFORNIA 2016

	California		California Excl. Bay Area		Bay Area	
	Total	Percent	Total	Percent	Total	Percent
Total	39,250,017	100%	32,912,100	100%	6,337,917	100%
Latino	15,280,776	39%	13,801,804	42%	1,478,972	23%
White	14,725,729	38%	12,423,728	38%	2,302,001	36%
Asian	5,602,074	14%	3,735,627	11%	1,866,447	29%
Black	2,265,280	6%	1,884,989	6%	380,291	6%
Other Race or Ethnicity	1,376,158	4%	1,065,952	3%	310,206	5%

Source: 2016 American Community Survey 1-Year Estimates, Table B01001series, accessed through <https://factfinder.census.gov/>, accessed February 2018

Table 3.5

NET POPULATION CHANGE BY RACE AND ETHNICITY, BAY AREA, CALIFORNIA EXCLUDING THE BAY AREA, AND U.S. EXCLUDING CALIFORNIA, 2007–2016

	California		California Excl. Bay Area		Bay Area	
	Net Growth	Percent Growth	Net Growth	Percent Growth	Net Growth	Percent Growth
Total	2,696,802	7%	2,063,663	7%	633,139	11%
Latino	2,059,888	16%	1,840,337	15%	219,551	17%
White	-797,520	-5%	-700,320	-5%	-97,200	-4%
Asian	1,090,667	24%	666,451	22%	424,216	29%
Black	1,917	0%	21,243	1%	-19,326	-5%
Other Race or Ethnicity	341,850	33%	235,952	28%	105,898	52%

Source: see Table 3.4

occurred outside the Bay Area. The Asian population expanded by over 1 million, and nearly 39% of this growth was in the Bay Area.

Table 3.6 compares the racial and ethnic composition of California in 2016 with the United States excluding California. A much lower proportion of the California population is white or black, and a much greater proportion is Latino and Asian than in the rest of the nation. Although about 12% of the total U.S. population is located in the state, California has 7% of the

national white population and 6% of the U.S. black population. In contrast, the state includes 27% of the total U.S. Latino population and 32% of the nation’s Asian population.

California is the largest minority-majority state in the country, and is becoming more diverse more rapidly than the rest of the nation. To prove worthy of emulation elsewhere, California must demonstrate that the state’s racial and ethnic groups can each enjoy a high quality of life notwithstanding the increased costs of living (from an already

Table 3.6

TOTAL POPULATION BY RACE AND ETHNICITY CALIFORNIA AND THE U.S. EXCLUDING CALIFORNIA, 2016

	California		U.S. Excl. California	
	Total	Percent	Total	Percent
Total	39,250,017	100%	283,877,498	100%
Latino	15,280,776	39%	42,117,943	15%
White	14,725,729	38%	182,753,721	64%
Asian	5,602,074	14%	11,954,861	4%
Black	2,265,280	6%	38,628,089	14%
Other Race or Ethnicity	1,376,158	4%	8,422,884	3%

Source: see Table 3.4

high level) that result in large part from the state’s climate change and related policies. The following sections show that, even in the Bay Area, California has fallen far short of this fundamental objective.

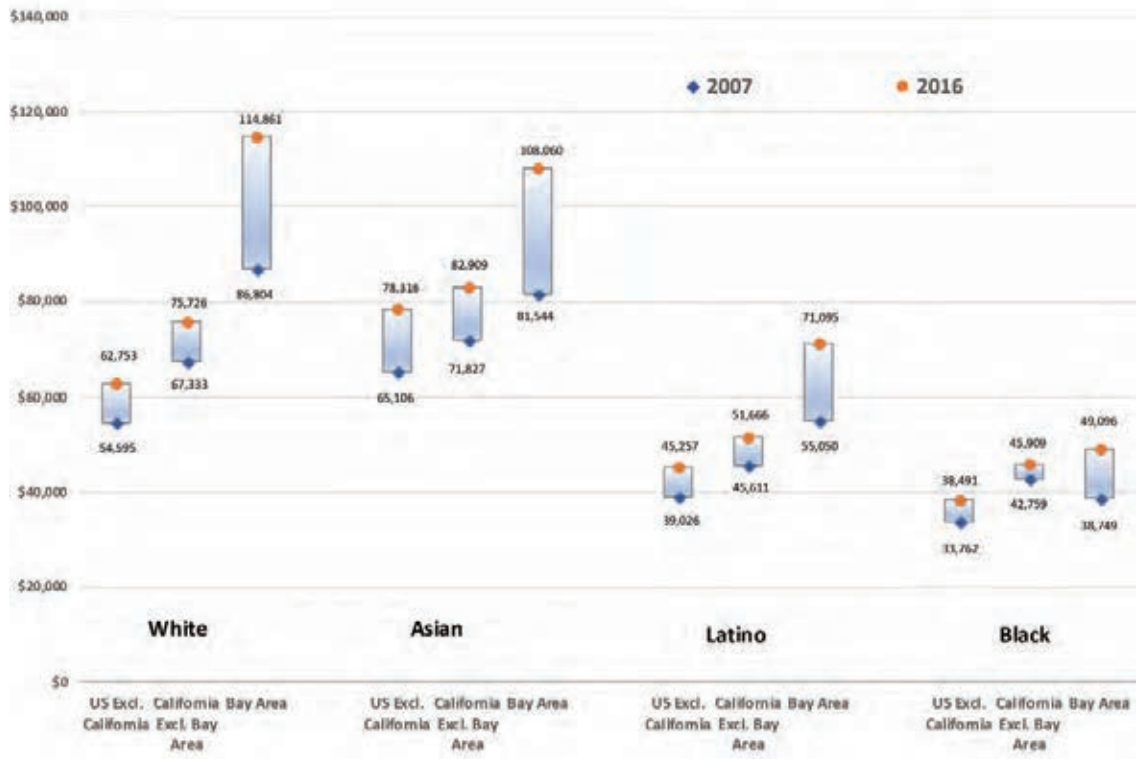
2 Disparate income, housing and educational attainment impacts.

Figure 3.7 summarizes the median household incomes in the U.S. outside of California, California excluding the Bay Area and the Bay Area in 2007 and 2016 by race and ethnicity. Consistent with the regional

growth and income disparity that occurred in California since 2007, there was a significant difference between median incomes for most groups in the Bay Area and the rest of the state as well as in the rest of the country. Incomes for each group rose by a greater amount in the Bay Area during 2007-2016, particularly for Bay Area white and Asian residents. 2016 median incomes for Bay Area white and Asian residents were substantially higher than in the rest of the state and nation. In contrast, the range and magnitude of the changes in median incomes over 2007-2016 in California excluding the Bay

Figure 3.7

MEDIAN INCOME IN 2007 AND 2017, WHITE, ASIAN, LATINO AND BLACK POPULATIONS BAY AREA, CALIFORNIA EXCLUDING THE BAY AREA, AND U. S. EXCLUDING CALIFORNIA (nominal current dollars)¹⁶⁵



Source: Median income estimated from household income distributions for 2007 and 2016 American Community Survey 1-Year Estimates, Table B19001 series, accessed through <https://factfinder.census.gov/>, accessed February 2018 using the estimation methodology published by the California Department of Finance (see http://www.dof.ca.gov/Forecasting/Demographics/Census_Data_Center_Network/documents/How_to_Recalculate_a_Median.pdf).

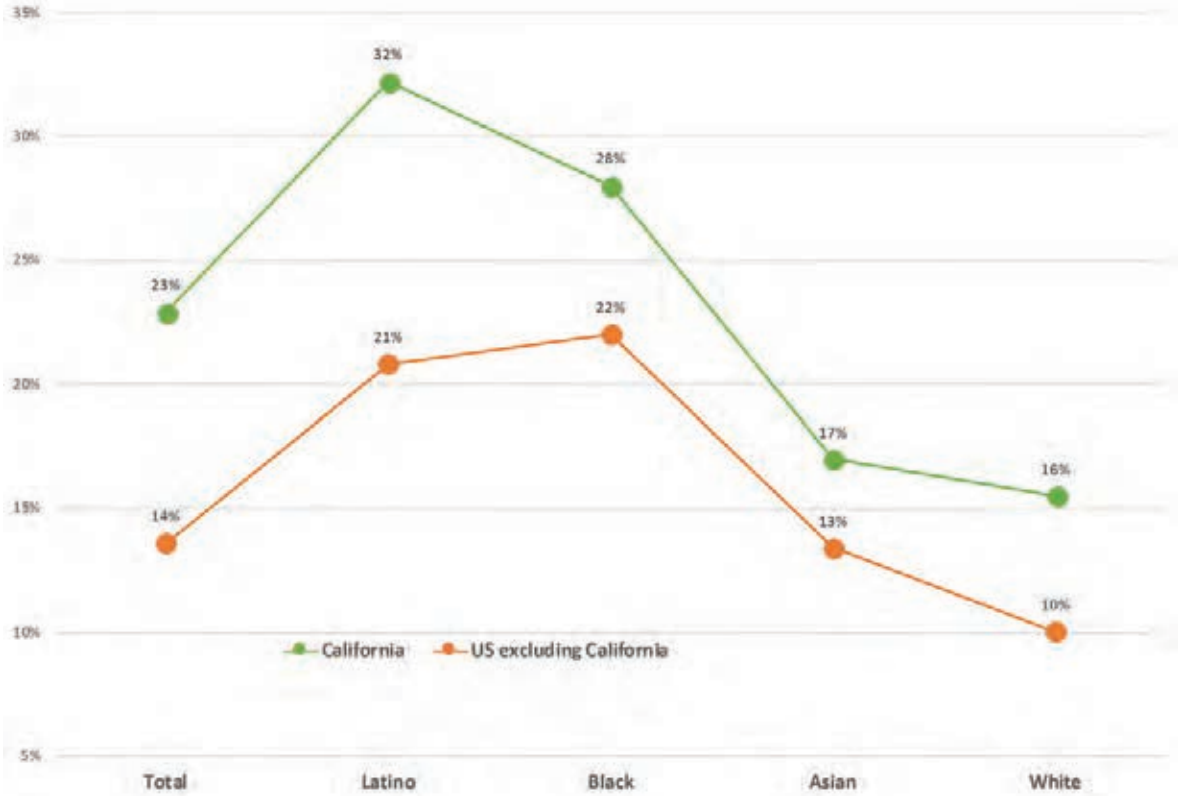
Area were generally similar with the pattern of median incomes in the U.S. outside of the state. Despite the state’s much higher costs of living, median incomes did not rise as rapidly or to the same extent for all groups relative to the rest of the U.S. outside of the Bay Area.

Figure 3.7 also shows that there were significant income disparities by race and ethnicity. Median incomes and income growth for Latino and black populations were much lower than for the white and Asian populations in all locations. The difference between the higher and lower income groups, however,

was larger in California. In 2016, for example, Latino median incomes were \$11,855 lower than white median incomes in the U.S. outside California, but \$13,824 lower than white median incomes in California excluding the Bay Area and \$25,544 lower in the Bay Area. Black median incomes were \$18,621 lower than white median incomes in the rest of the nation, \$19,582 lower in California outside the Bay Area, and \$47,543 lower than the white median income in the Bay Area. The data show that California’s Latino and black populations in all of the state ---including the Bay Area --- had much lower household incomes relative to the

Figure 3.8

NAS-BASED ESTIMATES OF THE PERCENTAGE OF POPULATION LIVING IN POVERTY CALIFORNIA AND THE US EXCLUDING CALIFORNIA 2016



Sources: CPS Table Creator, <https://www.census.gov/cps/data/cpstablecreator.html> for official and NAS-based estimated, Consumer Expenditure Survey (CE)-based threshold and NAS income less medical out of pocket expenditure (see <https://www.census.gov/cps/data/povthresholds.html>) and geographic price difference adjustment).

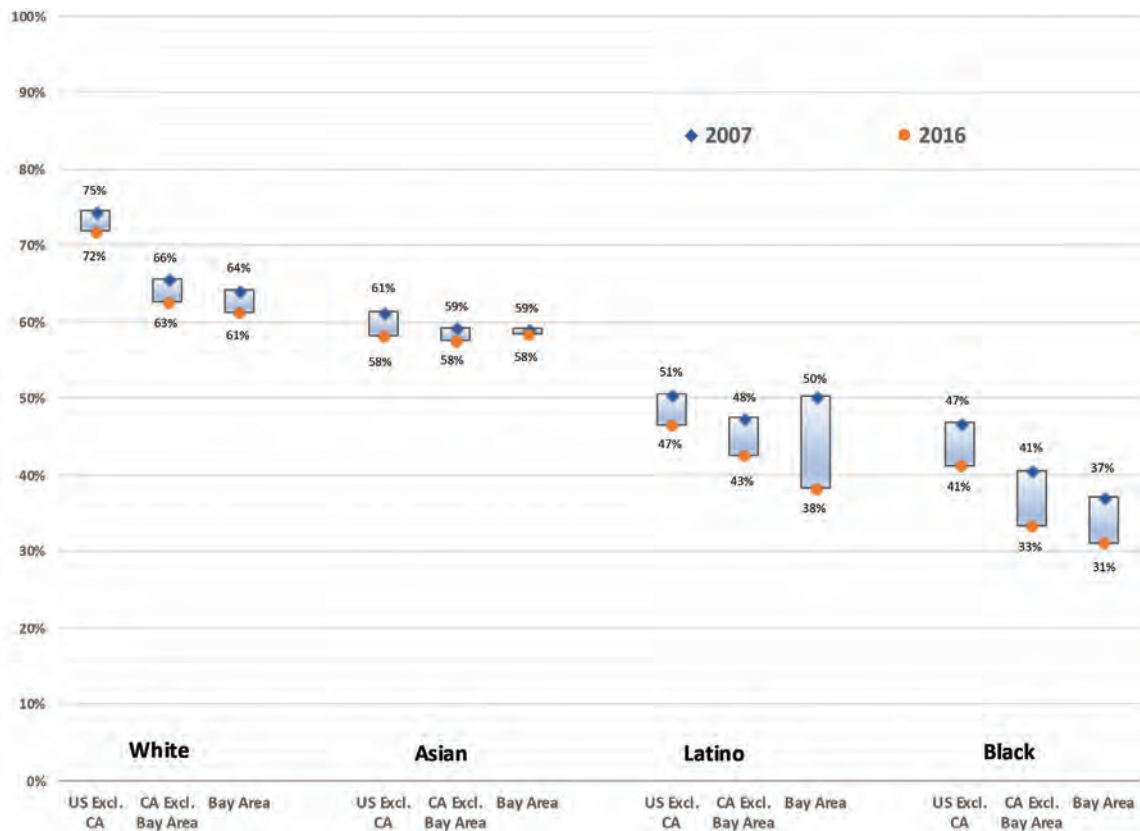
state's white and Asian populations. These groups appear to be much more significantly affected by regressive energy, housing and other cost increases associated with state climate policies. As shown in Figure 3.8, when poverty rates are calculated by using thresholds that take into account consumer expenditure and geographic cost differences, far more of the state's population, and particularly Latino and black residents, are impoverished than in the rest of the country.

Due to regulatory constraints and costs, including state climate policies that increase

energy prices and require significant and expensive energy efficiency installations, as well as permitting reviews that are heavily weighted against lower cost housing development in suburban areas,¹⁶⁶ California failed to build sufficient housing to meet demand in almost all areas of the state. The average cost of a home in California is about 2.5 times higher than in the rest of the U.S., and several times higher in coastal urban communities, including the Bay Area, the western portions of Los Angeles County, and in Orange and San Diego counties. The average rent in the state is also about 50%

Figure 3.9

PERCENT CALIFORNIA HOUSEHOLDS IN OWNER OCCUPIED HOUSING, BAY AREA, CALIFORNIA EXCLUDING THE BAY AREA, AND U.S. EXCLUDING CALIFORNIA, 2007–2016



Source: 2007 and 2016 American Community Survey 1-Year Estimates, Table B25003 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

higher than in the rest of the country and much higher in coastal urban areas.¹⁶⁷ Recent affordable housing impact fee assessments in the Bay Area and Los Angeles indicate that rents in these markets range from \$2,500-\$3,800 per month for approximately 850-1,100 square foot apartments in low, mid and high rise structures.¹⁶⁸

Figure 3.9 summarizes the rate of homeownership (households living in owner occupied housing) in the U.S. outside of California, California excluding the Bay Area and the Bay Area in 2007 and 2016 by race and ethnicity. Homeownership rates fell throughout the country during 2007-2016 in the wake of the 2007-2009 recession but were especially low in California. By 2016, the overall homeownership rate in the state was just under 54% compared with 64% in the rest of the country.

Figure 3.9 shows that while Latino and black homeownership rates were much lower than for white and Asian households in all parts of the U.S., this homeownership disparity was particularly large in California. In 2016, the percentage of white households living in owner-occupied housing ranged from 72% in the rest of the U.S. to 61% in the Bay Area. Asian homeownership rates were about 58% in all locations. The percentage of Latino households living in owner-occupied housing, however, was 47% in the U.S. outside of California, 43% in California outside the Bay Area, and fell from 50% in 2007 to just 38% by 2016 in the Bay Area. Black homeownership rates were 41% in the nation excluding California, but only 33% in the state outside the Bay Area and 31% in the Bay Area.

Homeownership remains one of the most important means for increasing household wealth, educational attainment, voter participation rates, multi-generational housing stability, individual and family health, and upward mobility. As discussed in a 2015 report by the California Legislative Analyst's

Office (LAO), for example, homeownership helps households build wealth by effectively mandating monthly savings in the form of mortgage payments while monthly housing payments by renters do not accrue as ownership equity and generate savings. The LAO estimated that, in 2013, despite the still-lingering effects of the recession at that time, the median renter household in California had a net worth of only \$5,400 compared with \$195,400 for median owner-occupied households.¹⁶⁹

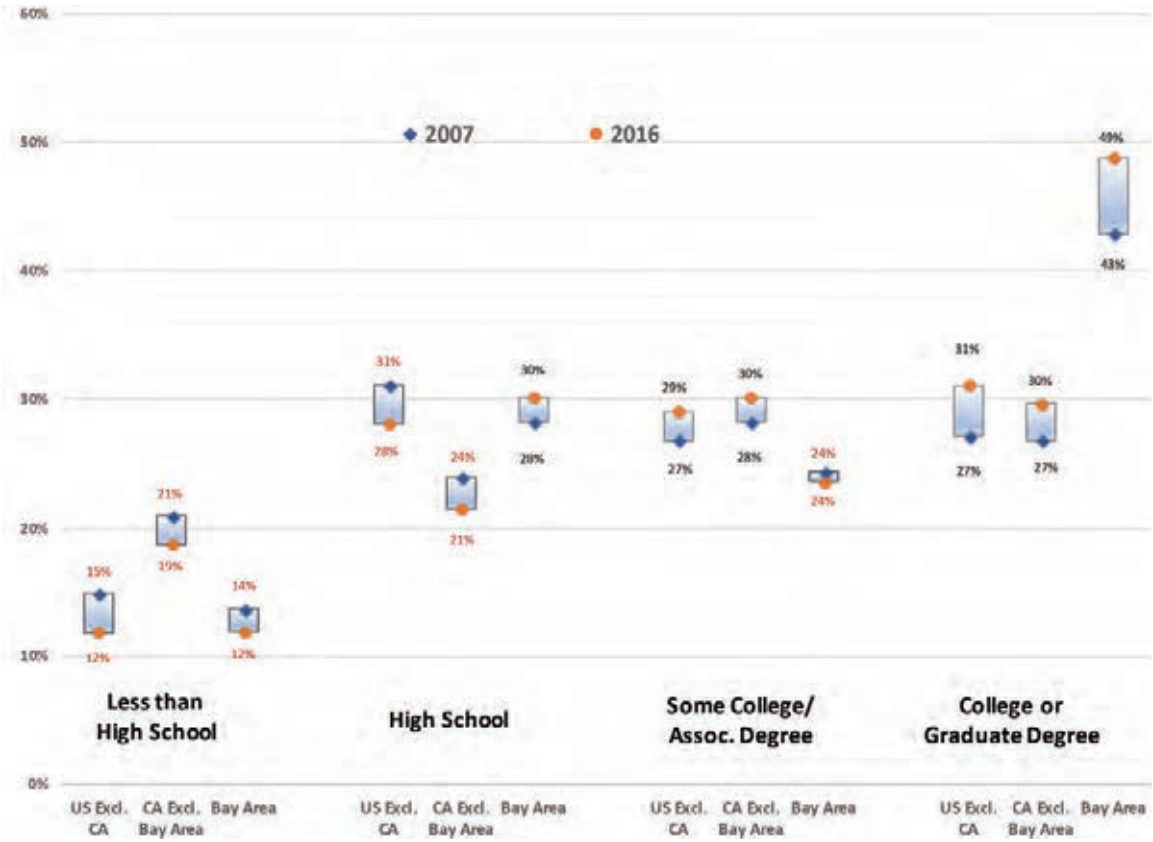
As discussed in Section 2 of this report, the Scoping Plan and related state policies focus on building dense, multifamily housing in existing urban areas to reduce GHG emissions. The costs of building these homes, however, are many times the income available to most state households, and particularly unaffordable for the majority of Latino and black households. Assuming local residents will allow (and not use CEQA or other regulatory means to block) such new housing, the cost of building affordable housing in California's urban areas can exceed \$700,000 per unit.¹⁷⁰ The state has allocated at least 10% of revenue from the sale of cap and trade allowances to the newly-created Affordable Housing and Sustainable Communities (AHSC) Program, developed and administered by the Strategic Growth Council, to compensate for the significantly higher housing costs state policies help to create. The amount of this funding was about \$255 million in 2018.¹⁷¹ Compared with an estimated shortfall of 3.5 million homes in the state,¹⁷² the 2018 AHSC funding would pay for the construction of fewer than 400 affordable housing units at \$700,000 per unit, or just over 1,000 units if construction costs could somehow be reduced to just \$250,000 per unit. Over a 20 year period, assuming similar funding and cost levels over the next 20 years, the program could add about 8,000 new affordable homes in California at \$700,000 per unit, or 20,000 units at \$250,000 cost per unit. Construction of

this magnitude would account for 0.2% to 0.6% of the existing, let alone future, state housing shortfall.

California’s income disparities and low homeownership rates have also adversely affected the population with relatively low educational attainment. Figure 3.10 summarizes the educational attainment of adults over 25 years of age (“adults”) in the U.S. outside of California, California excluding the Bay Area and the Bay Area in 2007 and

2016 by race and ethnicity. In 2016, about 4.6 million (17.6%) of all California adults had less than a high school education, by far the largest population of adults who lack even a high school diploma in the United States. Adults without a high school education were disproportionately located in California outside of the Bay Area (19% of the adult population), compared with 12% in the rest of the U.S. and the Bay Area. About 30%-31% of the adults in California outside the Bay Area and the rest of

Figure 3.10
EDUCATIONAL ATTAINMENT, CALIFORNIA EXCLUDING THE BAY AREA, AND U.S. EXCLUDING CALIFORNIA, 2007–2016 (values in red=decrease from 2007 to 2016)



Source: 2007 and 2016 American Community Survey 1-Year Estimates, Table B25013 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

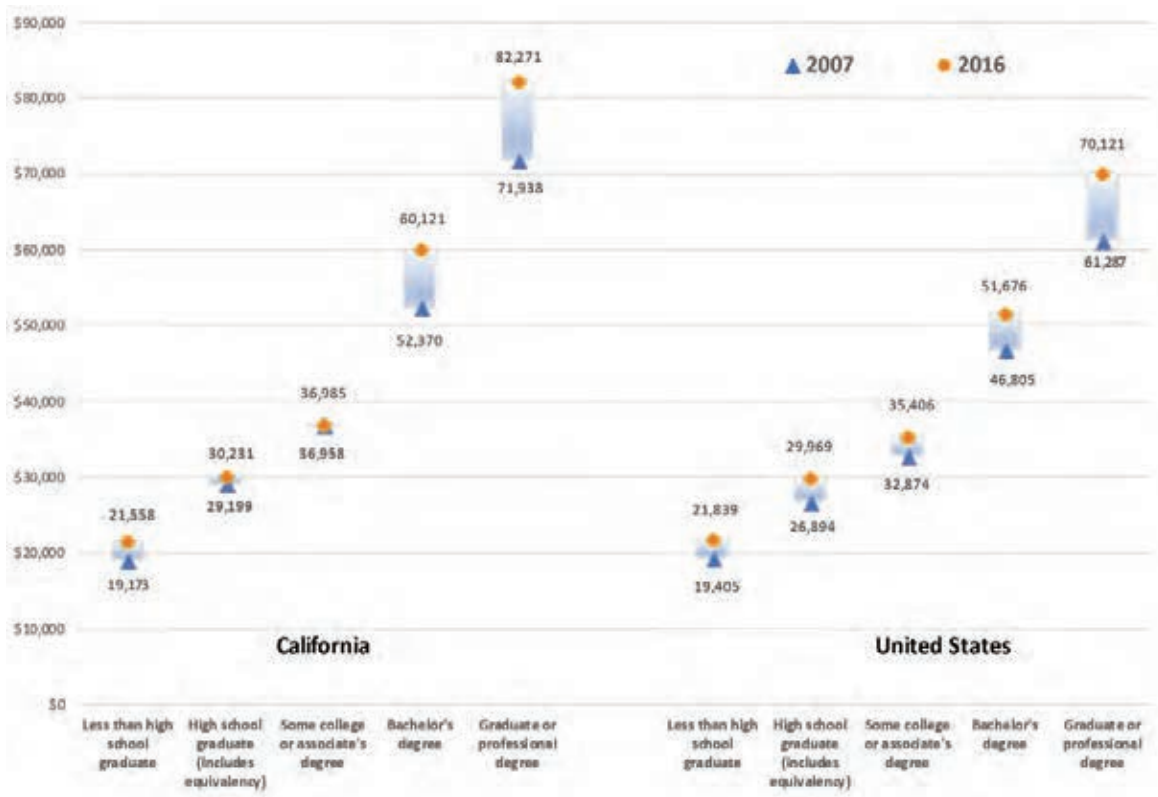
the nation had college or graduate/professional degrees in 2016, far less than the nearly 50% of all adults in the Bay Area.

As discussed above, since 2007 California lost nearly 160,000 manufacturing jobs, all outside of the Bay Area. Since 2010, the state created only 60,000 new manufacturing jobs (a 4.8% increase) compared with 855,000 new manufacturing jobs (an 8.3% increase) in the rest of the country.¹⁷³ The state created 419,000 new trade, transportation and utilities jobs outside of the Bay Area during 1997-2007, but only 111,000 new jobs in these industries

during 2007-2017. The manufacturing sector, as well as the trade, transportation and utilities sectors, provide higher wage employment opportunities for less educated residents, but are highly sensitive to housing, energy and other costs of living. Global and national competitive pressure does not allow these industries to pay wage premiums to compensate for California's far higher housing costs. Employers in higher energy consuming manufacturing and transportation sectors must also pay higher California costs for electricity and transportation fuels. As discussed in

Figure 3.11

MEDIAN INCOME BY EDUCATIONAL ATTAINMENT, CALIFORNIA AND THE UNITED STATES 2007-2016 (nominal current dollars) ¹⁷⁴



Source: 2007 and 2016 American Community Survey 1-Year Estimates, Table B15002 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

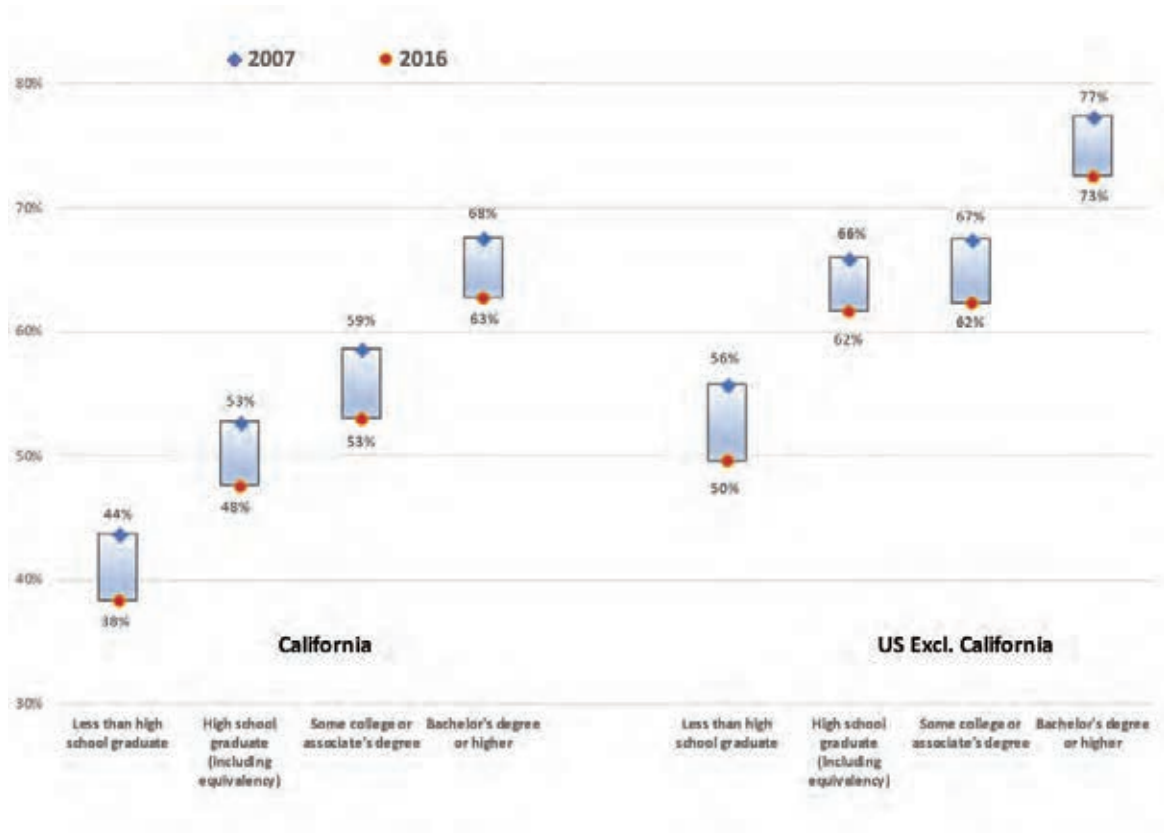
Section 2 of this report, even the wealthiest California companies, including Apple, Google and Facebook, choose to locate higher energy-consuming data centers and manufacturing in other states and countries with lower energy, housing and labor costs.

Figure 3.11 compares median incomes by education attainment for California and the United States during 2007-2016. The data show that there is very little difference in incomes earned by workers with less than high school education, a high school education alone, and those that completed at least some college or

earned a degree from a community college in either location. Incomes for college graduates and workers with a graduate or professional degree in California are significantly higher than in the rest of the U.S. In general, less educated California residents—many historically employed in blue collar industries—are not able to earn incomes that substantially differ from incomes in the rest of the country despite the state’s much higher costs of living. State residents with a college or graduate education, however, do earn a substantial income premium compared with similarly

Figure 3.12

PERCENT OWNER-OCCUPIED HOUSEHOLDS BY HEAD OF HOUSEHOLD’S EDUCATIONAL ATTAINMENT, CALIFORNIA AND THE UNITED STATES EXCLUDING CALIFORNIA, 2007-2016



Source: 2007 and 2016 American Community Survey 1-Year Estimates, Table B25013 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

educated residents in the rest of the country, particularly if they are employed in the Bay Area.

Educational attainment also correlates with homeownership rates, but a much lower percentage of Californians without college degrees own a home than in the rest of the U.S. Figure 3.12 compares homeownership rates in the U.S. outside of California and within California for 2007 and 2016 by adult educational attainment. Outside of California, 50% of all households headed by an adult with less than a high school education are able to live in owner occupied housing versus just 38% in California. About 62% of households headed by an adult with a high school education or less than a 4-year college degree are owner occupied compared with 48% (high school education) and 53% (some college) in California. The data also show how the state’s much higher housing costs adversely affect all income classes. A significantly greater proportion of households live in owner occupied housing at all levels of educational attainment in the country outside California.

As discussed above, the Scoping Plan and other state policies seek to make automotive travel more expensive, and put California on a “road diet” to increase congestion and stimulate reliance on bus systems and other non-automobile transportation modes. As shown in Table 3.7, the state embarked on this strategy at a time when the white population is declining, and Latino and Asian residents

have significantly increased their reliance on driving to work rather than using public transit. Over 1.1 million additional Latino and nearly 400,000 new Asian workers commuted to work by driving alone from 2007 to 2016, while the number of white workers driving alone fell by 447,000. The data indicate that, statewide, the number of people using public transit rose by 68,000, all of this apparent increase was in the Bay Area and likely reflects the pervasive use of private buses by large employers such as Apple, Google and other regional firms.¹⁷⁵ Public transit use fell by 9% in California outside of the Bay Area and accounted for just 5% of all commutes to work statewide in 2016. About 78% of all commutes to work in 2016 consisted of driving alone.¹⁷⁶

One reason why the state’s most rapidly growing populations have overwhelmingly chosen to commute to work by driving alone is travel time. In 2016, 41% of all California public transit work trips lasted for an hour or more, and 58% of all public transit work trips extended for more than 45 minutes. Despite the state’s efforts to make automotive use less convenient, in 2016 only 11% of all commutes by driving alone lasted an hour or more, and just 19% extended for at least 45 minutes. Rather than create transit options that better serve the state’s residents by reducing travel times, the proportion of longer trips by both driving alone and public transit increased at about the same rate during 2007-2016. Trips lasting an hour or more by driving alone or using public

Table 3.7

NET CHANGE IN TRAVEL TO WORK BY RACE AND ETHNICITY IN CALIFORNIA DRIVING ALONE AND PUBLIC TRANSIT USE, 2007–2016

	Total	White	Asian	Latino	Black
Drive Alone	1,172,998	-447,063	377,615	1,117,273	18,590
Public Transportation	68,434	44,276	53,305	-35,483	-2,756

Source: 2007 and 2016 American Community Survey 1-Year Estimates, Table B08105 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

Table 3.8

TRAVEL TIME TO WORK, CALIFORNIA EXCLUDING BAY AREA, BAY AREA AND CALIFORNIA, 2016

	California Excl. Bay Area	Bay Area	California
Total	13,928,001	2,953,673	16,881,674
1-20 minutes	5,303,185	867,322	6,170,507
20-45 minutes	5,829,557	1,299,658	7,129,215
45-60 minutes	1,152,101	341,371	1,493,472
60 minutes or more	1,643,158	445,322	2,088,480

Source: 2007 and 2016 American Community Survey 1-Year Estimates, Table B08105 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

transit rose by 32% and 26% statewide, and by a much higher rate of 79% and 72% in the Bay Area. As shown in Table 3.8, in 2016 the number of commuters that spent at least an hour commuting to work rose to 2,088,480, an increase of 433,941, or 26% from 2007 levels. A disproportionate share of this increase was attributable to the Bay Area, where less affluent workers are required to travel particularly long distances using increasingly insufficient roadways and transit systems. Each workday about 445,00 people in the Bay Area (an increase of 189,374, or 74% from 2007) and 1.6 million in the rest of the state (an increase of 244,567, or 17% from 2007) must travel at least an hour to get to work.¹⁷⁷ As the state’s commuting workforce has shifted from the white to the Latino and Asian populations, the Scoping Plan will only increase the time lost just to get to work by minority residents in the state.

C. THE COSTS OF UNILATERALISM

The Scoping Plan does not consider how state policies that increase housing, energy and other costs disproportionately harm vulnerable and disadvantaged populations. CARB’s analysis of potential impacts from the state’s

climate policies is largely based on extrapolating the state’s recent pattern of growth, which has been dominated to a unique, if not unprecedented extent by the Bay Area. Since 2007, economic opportunities in the rest of the state have been substantially reduced from the prior decade, and incomes and homeownership rates for Latino and black households substantially lagged those of white and Asian households. Employment opportunities for less educated workers in manufacturing, logistics and similar fields have been reduced by the state’s uncompetitive energy and housing costs. Workers that do have jobs, including a growing number of Latino and Asian residents, must spend a substantial and growing amount of time each day traveling to work.

Figure 3.13 shows the percentage of households in the state by income group by race and ethnicity in 2016. After a decade’s worth of the growth analyzed in the Scoping Plan, 53% of all black households and 47% of all Latino households continued to earn less than \$50,000 per year. Only 14% of all black and 12% of all Latino households earned more than \$125,000 per year. Although the state’s white and Asian households have proportionately higher incomes, 32% of the state’s white households and 30% of all Asian households

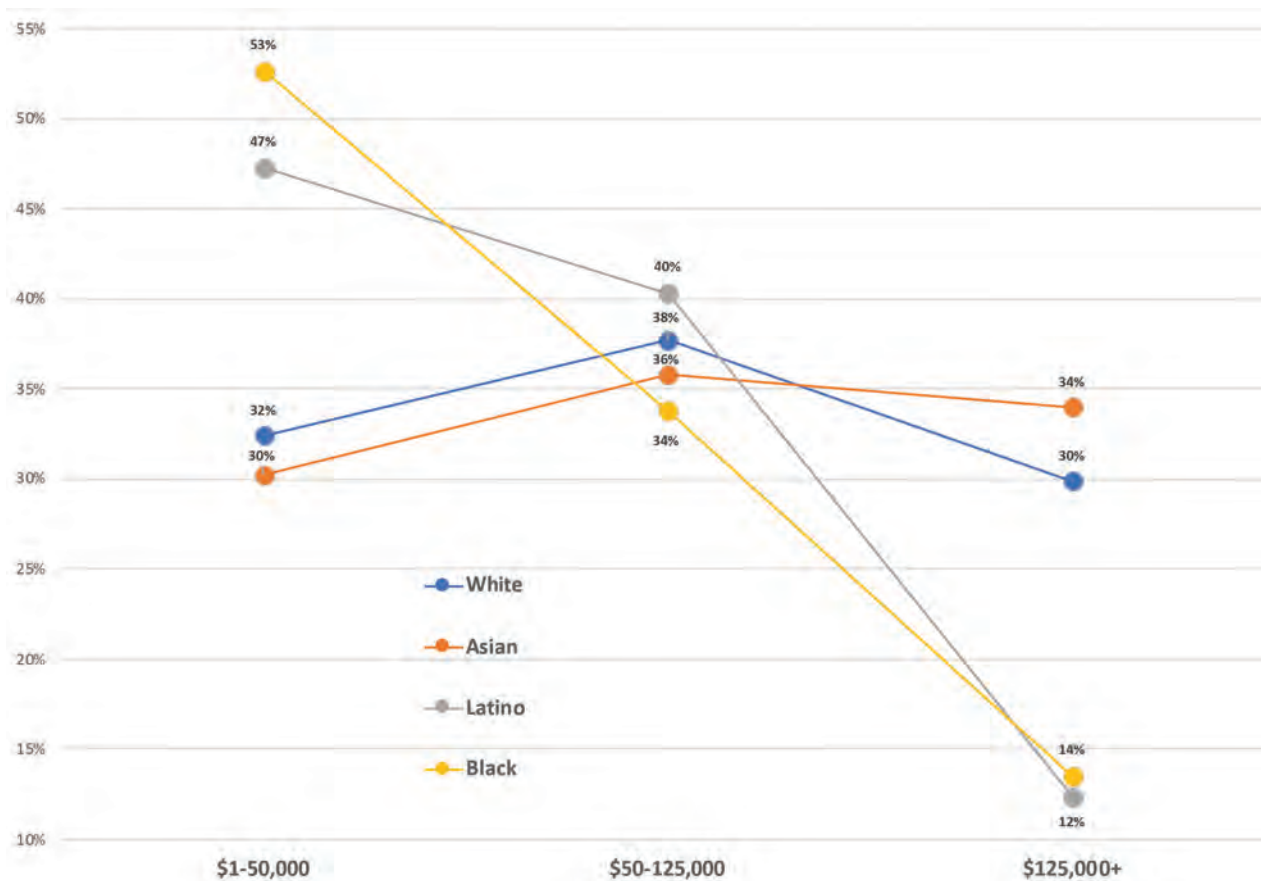
also had incomes under \$50,000. To the extent the Bay Area “model” of growth works, it is only effective in the context of the region’s unique conditions. The rest of the state, and disadvantaged residents within the Bay Area, have been harmed by the state’s substantially higher costs of living. California’s climate change and related policies will only add to their burdens without ensuring that global GHG concentrations will be meaningfully reduced.

IV. CONCLUSION: TOWARDS CLIMATE 2.0

California produces less than 1% of all global anthropogenic GHG emissions and has one of the lowest per capita emissions levels in the United States. The state’s emissions per GDP are lower than all but a few developed and other industrial countries. Yet, California’s climate policy regulators and leaders have determined that the state must reduce GHG emissions by 2030 to an extent no Paris Agreement

Figure 3.13

PERCENT OF CALIFORNIA HOUSEHOLDS BY RACE, ETHNICITY AND INCOME GROUP, 2016



Source: Compiled from 2007 and 2016 American Community Survey 1-Year Estimates, Table B19001 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

participant has to date proposed to achieve. Just as some of the strongest supporters of the agreement, such as Germany, are shifting from national to regional and international reduction objectives, California remains even more committed to unilateral climate action. As discussed in Section 2, California has not come close to reducing either mass or per capita GHG emissions as much as in other parts of the U.S., including states that have been relatively indifferent to the risks of climate change.

Despite its surprisingly ineffective record, the state still intends to push ahead with policies and seems determined to ignore adverse effects on the large proportion of its population already burdened by higher energy, housing and other costs, including minority, less affluent, and less educated residents. The real-world effects that the Scoping Plan and related climate policies will have on the millions of Californians who are today in or near poverty, and those who are struggling just to make ends meet, have never been seriously or transparently evaluated.

The most radical provisions of the Scoping Plan would end the authority of cities and counties, and local voters to shape the character of their communities, intentionally increase traffic congestion for workers who have been forced to drive the longest distances to housing they can afford to purchase or rent, increase basic living costs for electricity, housing and fuel and expand the use of anonymous CEQA lawsuits to stall any plan or project anywhere, anytime and for any reason in the state.¹⁷⁸ These policies are likely to reduce, if not end the expansion of home ownership, manufacturing and other working and middle class jobs which still provide critical opportunities for upward mobility.

Much larger GHG reductions have been and continue to occur in other parts of the

country without resorting to the radical measures in the Scoping Plan simply by replacing less efficient energy fuels, such as conventional coal, with natural gas or more technologically advanced coal fired facilities. A much larger share of the population in most states that have achieved greater emissions reductions enjoy significantly higher homeownership rates at all income levels, and their economies provide a greater range of working and middle-class employment opportunities as well as the high-end employment that has flourished in the Bay Area.

Scoping Plan measures that would further reduce homeownership levels, reduce the state's remaining manufacturing and other working and middle class jobs, and further crowd the nation's densest urban communities have never been approved by the state legislature. Indeed, many of these efforts have been expressly rejected when considered by elected officials. None have been presented to, let alone approved by state voters.

The only real impact California can have on global GHG emissions, and potential temperature changes over the next 80 years, is by implementing commonsense measures that do not disproportionately hurt large segments of the population and can, in the best case, only be realized in a region like the Bay Area with enormous wealth and unique workforce demographics. The state's climate policies must respect the social equity principles of the Paris Agreement, comply with civil rights and equal protection laws, and build a sustainable political consensus that includes feasible solutions to the epidemic of poverty and lack of housing in California. At the same time, the state must stop pretending that massively costly programs with relatively small, if not minute GHG reduction benefits like high speed rail and urban densification are praiseworthy and

effective means for addressing climate change while the state exports people, jobs, and the goods and services it consumes to higher-emission locations.

To effectively lead on climate change, California should implement the following climate change policy reforms:

1. Effective climate regulations require transparency and accountability to California consumers and voters. As discussed in Section 2, the 1972 Clean Air Act reduced vehicular tailpipe emissions by 99%, and dramatically reduced emissions from manufacturing, power plants, and scores of other pollution sources, in a series of regulations that began as proposals informed by both costs and benefits. CARB has to date failed to disclose the true costs, and the global GHG reduction consequences, of any of the Scoping Plan measures. State policies have instead been evaluated against potential “avoided” future costs such as enhanced flood protection, even though California accounts for a minuscule amount of anthropogenic GHG emissions in future IPCC scenarios. The use of highly aggregated and speculative cost information to assess climate change policy impacts must cease. The real consequences of high cost, dense housing, the decline of working and middle class employment, slower job growth in those portions of the state that do not have the Bay Area’s resources or demographics, and lower homeownership must be quantified and disclosed for all income and ethnic groups in the state.
2. Each climate measure in the Scoping Plan and related policies must be ranked, and prioritized to meet legislated GHG reductions. The ranking process must specifically explain and consider how each measure will avoid leakage, emissions shuffling, or the diversion

of economic activity and population to other locations. Climate measures that result in GHG emission leakages must be adequately considered, and other approaches, such as significant improvements in state forest management, should be highly prioritized. Measures with higher leakage risks and less cost effectiveness should be avoided. Exporting manufacturing and production jobs, and driving out middle class jobs to states where housing is more affordable exacerbates income inequality, violates the civil rights of California minorities, and are counterproductive to global reductions of GHG emissions. The ranking process must also be systematically applied to the Scoping Plan's unauthorized 80% GHG reduction goal for 2050, an objective that has been expressly considered and repeatedly rejected by the state legislature. None of the measures in the Scoping Plan should be implemented absent specific legislative and voter approval.

3. Climate change policies, including planning and ongoing programs and measures, must be periodically assessed and updated. The Scoping Plan includes hundreds of measures, many blindly approved without the slightest assessment of feasibility, cost, or effectiveness. The unthinking breadth of the state climate policies actually reduces the potential for technological change and innovation by discouraging steps for the state to experiment with new approaches. Technology evolves, and public funding and regulations can enhance technological development and deployment. However, scientifically and economically feasible solutions that avoid immoral unintended consequences like the “blood batteries” of child and slave labor mining for rare minerals, are currently unknown. When the Clean Air Act was

adopted in 1972, no one anticipated the technological advances that allowed for the reduction of vehicular tailpipe emissions by 99%, even as automobile use and gasoline sales expanded dramatically in California and the rest of the nation. Periodic and regular reviews of the cost effectiveness of state policies will allow for the consideration of alternative, potentially far superior options that could not be envisioned when the Scoping Plan was approved.

For more than a century, sincere advocates and leading scientists have characterized then-current problems as insurmountable environmental crises. Many were nonetheless overcome through some combination of scientific, technological, economic, and political progress. In the late 1880s, major cities in the world were in the midst of a horse manure crisis. Experts predicted that in 50 years every street in London would be under 9 feet of manure and that urban civilization was doomed. The crisis abated with the developing of entirely new transportation technologies that completely superseded the use of animals.¹⁷⁹ Industrial pollution caused the Cuyahoga River in Cleveland to catch fire in 1969 and ushered in the Clean Water Act of 1972. For decades managing huge volumes of human and industrial wastes in the nation's rivers and oceans was a major environmental concern. Over time, and with clear and transparent regulatory programs, water quality protection has become an unquestioned political priority throughout the country and water quality has substantially improved. And, as discussed in Section 2, air pollution from factories and vehicles appeared to be an intractable problem that was nonetheless significantly reduced—and in the case of vehicular emissions of concern, nearly eliminated—through the implementation of the Clean Air Act.

Even within California there are examples of alternative approaches that would address climate change without foreclosing affordable housing, the possibility of upward mobility, and more balanced development. In 2012, the Southern California Association of Governments (SCAG) adopted a Sustainable Communities Strategy (SCS) and certified a final environmental impact report (EIR) for addressing climate change as required by state law.¹⁸⁰ The SCS plan and EIR considered the infill development and VMT reduction approaches in the CARB Scoping Plan and concluded that the negative economic and social impacts from these strategies would be too great in comparison with less restrictive alternatives. The adopted SCS, for example allows for an approximately even mix of infill and non-urban, greenfield development over a 20 year period that would facilitate a reasonable mix of expensive, small urban housing and less dense, often more affordable single family and larger suburban homes. VMT reductions would occur under the SCS, but the SCAG plan does not propose to actively inhibit vehicular use and seeks to preserve market incentives for travel, work and living to a greater extent than in the Scoping Plan. The SCAG SCS has been approved by CARB (in 2012 and again in 2016), and provides a much more common sense approach to addressing climate change than utilized in the Scoping Plan because it considers socioeconomic effects as well as potential GHG emission reductions.

Climate change is an urgent challenge, and California has staked out a global position of leadership. To maintain its influence and stature, the state must also respond to and alleviate the urgent needs of its enormous, and growing, impoverished, homeless, and struggling population. California must restore the economic prospects of the vast majority of the state – by region and race – now suffering from

a stagnant economy and surging prices. Climate change measures must remain subordinate to, and in alignment with, constitutionally guaranteed civil rights, equal protection, and due process and cannot supersede, absent appropriately enacted legislation, federal and state laws. State policies cannot hope to succeed if they foster even more anonymous CEQA lawsuits aimed at stopping (or leveraging for

economic gain) housing, transportation, and other plans and projects desperately required to address the state's poverty and housing crisis.

To borrow Silicon Valley's now-universal terminology, we need California Climate 2.0, sustainable climate change measures that achieve net global reductions of greenhouse gas emissions, and allow for the greater equity and upward mobility for all Californians.

...the imposition by the state's Democratic party leaders of highly regressive climate schemes have engendered disparate financial hard-ships on middle and lower income workers and minority communities, while providing direct economic subsidies to wealthier Californians in environmentalist strongholds like Marin County.



1. Unless otherwise defined, the “Bay Area” in this report refers to the five counties that comprise Silicon Valley, the rest of the western Bay Area Peninsula, and the immediately adjacent east Bay Area region: Santa Clara County, San Mateo County, San Francisco County, Alameda County and Contra Costa County.
2. Compiled from 2007 and 2016 American Community Survey 1-Year Estimates, Table B15002 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.
3. Manufacturing employment data compiled from U.S. Bureau of Labor Statistics, Current Employment Statistics, 2010-2017, Manufacturing Employment, Annual Averages (Not Seasonally Adjusted), extracted from <https://www.bls.gov/data/>, accessed March 2018.
4. David Friedman earned a PhD from the Massachusetts Institute of Technology, Department of Political Science, where he studied economic development and policy issues and wrote a book about Japanese automated industrial production technologies. He was a Fulbright fellow (Japan), a National Science Foundation scholarship recipient, served as a policy advisor on the Democratic Leadership Council and was a New America Foundation fellow. Jennifer Hernandez is the daughter and granddaughter of union steelworkers in Pittsburg, California. She graduated with honors from Harvard University, earned her law degree at Stanford, received a California Lawyer of the Year award for her work on a 260,000 acre conservation and land use agreement between landowners and five major environmental organizations (Sierra Club, Natural Resources Defense Council, Planning & Conservation League, and Endangered Habitats League), received civil rights awards for her advocacy work in cleaning up and redeveloping properties in minority communities, was appointed by President Clinton to the Presidio National Trust Board, is the only California lawyer to receive top tier ranking for both environmental and land use/zoning Law by peers and clients in Chambers USA, and served the longest tenure (22 years) of any minority member of one of California’s leading environmental advocacy organizations, the California League of Conservation Voters. This research paper was prompted by the efforts of California civil rights leaders to restore homeownership opportunities and upward mobility for California’s minority families, including by persuading CARB and other state climate leaders to avoid exacerbating California’s housing and poverty crises, and align climate change priorities with civil rights, public health, environmental protection, and consumer protection laws. This advocacy effort has continued with a civil rights lawsuit against the California Air Resources Board’s 2017 Scoping Plan, which challenges CARB’s expansion of CEQA to further increase the litigation risks and costs of new housing, as well as electricity and transportation, and disparately harm California minorities already burdened by the state’s acute housing and poverty crises. See *The Two Hundred vs. California Air Resources Board* (4/27/2018), Case No. 18CECG01494, available at <https://publicportal.fresno.courts.ca.gov/FRESNOPORTAL/Home/WorkspaceMode?p=0> (accessed April 2018).
5. The Global Warming Solutions Act is codified at Cal. Health and Safety Code Section 38500 et seq., and became effective in 2006. The Act is often referenced as “AB 32,” the assembly bill number assigned to the legislation.
6. Senate Bill (SB) 32 amended the Global Warming Solutions Act to require that “In adopting rules and regulations to achieve the maximum technologically feasible and cost-effective greenhouse gas emissions reductions authorized by this division, the [California Air Resources Board] shall ensure that statewide greenhouse gas emissions are reduced to at least 40 percent below the statewide greenhouse gas emissions limit no later than December 31, 2030.” The SB-32 amendments were signed by Governor Jerry Brown on September 08, 2016.
7. California Air Resources Board, 2017 Edition California Greenhouse Gas Inventory for 2000-2015, June 2017, available at <https://www.arb.ca.gov/cc/inventory/data/data.htm>, accessed February 2018.
8. California Air Resources Control Board, California’s 2017 Climate Change Scoping Plan (November 2017), accessed at <https://www.arb.ca.gov/cc/scopingplan/scopingplan.htm> on February 2, 2018), page 99. Unless otherwise indicated, all references to the “Scoping Plan” in this document refer to the 2017 Scoping Plan adopted by CARB in December 2017.
9. The Scoping Plan also references GHG reductions contemplated in a memorandum of understanding (MOU) that originated with California and the German state of Baden-Württemberg and currently includes about 188 subnational signatories (Scoping Plan, page 99). The MOU was largely been advanced as a project of Governor Jerry Brown and has not been adopted by the California legislature or signed into law in any manner.

10. United Nations Framework Convention on Climate Change, Summary of the Paris Agreement, <http://bigpicture.unfccc.int/#content-the-paris-agreement>, accessed February 2 2018).
11. Scoping Plan, page 2.
12. Scoping Plan, page ES1.
13. Scoping Plan, page ES5.
14. Scoping Plan, page 18.
15. Scoping Plan, page ES 3.
16. Scoping Plan, summary Table 1, page 25. Only the last category of measures has been challenged in court, in a lawsuit filed by a civil rights advocacy group, as discussed further in Section III. See *supra* at n.5. In early May 2018, California's lead energy regulator, the California Energy Commission, recently imposed a requirement that most new homes be equipped with rooftop solar panels; this new mandate is estimated to increase California's exorbitantly expensive housing prices by more than \$10,000 per home, even though rooftop solar produces electricity at a higher cost than utility-scale renewable solar and wind plants, and even though residents unable to afford new homes or rooftop solar effectively help subsidize rooftop solar households by paying a proportionately higher cost for maintaining the state's stable electric utility grid. See Rob Nikolewski, California becomes first state requiring all new homes be built with solar, *San Diego Union Tribune*, May 9, 2018, <http://www.sandiegouniontribune.com/business/energy-green/sd-fi-newhomes-solar-20180509-story.html>, accessed May 2018.
17. Scoping Plan, page 50.
18. Scoping Plan, page 55.
19. In August 2017 the United States, which is a party, formally announced that it would withdraw from the agreement. United States Department of State, Communication Regarding Intent To Withdraw From Paris Agreement, August 4, 2017 (<https://www.state.gov/r/pa/prs/ps/2017/08/273050.htm>, accessed February 2018).
20. Based on 2016 American Community Survey 1-Year Estimates, Table B01001 series, accessed through <https://factfinder.census.gov/>, accessed February 2018. Since the mid-2000s, the U.S. Census Bureau American Community Surveys (ACS) have provided information about the following larger racial and ethnic groups in the U.S. and California: (1) Hispanic or Latino (of any race), (2) white (not Hispanic or Latino); (3) Black or African American alone; and (4) Asian alone. For ease of reference, these groups are referred to as: (1) Latino, (2) white, (3) black, and (4) Asian in this report. At the time this paper was prepared, American Community Survey data for 2016 was the most recent year available through the Census Bureau website at <https://factfinder.census.gov/>.
21. Unless otherwise defined, the "Bay Area" in this report refers to the five counties that comprise Silicon Valley, the rest of the western Bay Area Peninsula, and the immediately adjacent east Bay Area region: Santa Clara County, San Mateo County, San Francisco County, Alameda County and Contra Costa County.
22. California's climate zones and building requirements are summarized in The Pacific Energy Center's Guide to: California Climate Zones and Bioclimate Design, October 2006, available on the Pacific Gas and Electric Company website, https://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zones_01-16.pdf, accessed April 2018.
23. Compiled from 2007 and 2016 American Community Survey 1-Year Estimates, Table B15002 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.

24. Manufacturing employment data compiled from U.S. Bureau of Labor Statistics, Current Employment Statistics, 2010-2017, Manufacturing Employment, Annual Averages (Not Seasonally Adjusted), extracted from <https://www.bls.gov/data/>, accessed March 2018.
25. See the discussion in Section 2 of this report and the summary of emissions from fires and post-fire conditions based on Average Annual CalFIRE and Federal Firefighting Agency Wildfire Acreage calculated from CalFIRE, California Wildfires and Acres for all Jurisdictions (for the years 2007-2016), http://cdfdata.fire.ca.gov/pub/cdf/images/incidentstatsevents_269.pdf; Direct emissions estimates per acre from Thomas M. Binnicker, Greenhouse Gas Emissions From Four California Wildfires: Opportunities To Prevent And Reverse Environmental And Climate Impact, FCEM Report No. 2, March 12, 2008, <http://www.idahoforests.org/img/pdf/FCEMReport2Final3-6-08.pdf>; long term indirect emissions potential from Little Hoover Commission, Fire on the Mountain: Rethinking Forest Management in the Sierra Nevada, Report #242, February 2018, page 41 <https://static1.squarespace.com/static/55dc9bade4b05820bf02d414/t/5a78bfd8f9619af89b-fbd603/1517862883845/Little+Hoover+Commission+Report+on+Forest+Health.pdf>; accessed February 2018. The data indicate that total fire-related emissions could exceed 255 MMTCO_{2e}, or about 60% of the total of 440 MMTCO_{2e} reported by CARB for the state in 2015.
26. See Joe Cortright, Why Is 'Affordable' Housing So Expensive to Build?, CityLab, Oct 19, 2017, <https://www.citylab.com/equity/2017/10/why-is-affordable-housing-so-expensive-to-build/543399/>; Chris Maxwell, State Adds \$100M to AHSC NOFA, September 27, 2017 California Housing Partnership Corporation , <https://chpc.net/state-adds-100m-ahsc-nofa/> and California Housing Consortium, Affordable Housing and Sustainable Communities Program, <http://calhsng.org/ahsc/>; and Jonathan Woetzel et al., A Tool Kit To Close California's Housing Gap: 3.5 Million Homes By 2025, McKinsey Global Institute, October 2016, <https://www.mckinsey.com/global-themes/urbanization/closing-californias-housing-gap>, accessed March 2018.
27. Compiled from U.S. Bureau of Labor Statistics, Current Employment Statistics, 1997-2017, Total Nonfarm Employment, Annual Averages (Not Seasonally Adjusted), extracted from <https://www.bls.gov/data/>, accessed March 2018. The BLS aggregates data for the Bay Area in three regions, San Francisco-Redwood City-South San Francisco, San Jose-Sunnyvale-Santa Clara, and Oakland-Hayward-Berkeley.
28. Scoping Plan, page ES1.
29. European Environment Agency, https://www.eea.europa.eu/data-and-maps/daviz/observed-trends-in-total-global-2#tab-chart_1, accessed February 2018. Certain GHGs, such as methane, have a higher warming potential than CO₂, and the collective emissions and atmospheric concentrations of these gases scaled to the warming potential of CO₂ are referred to in terms of "CO_{2e}." CO₂ accounts for about 80% of anthropogenic GHG emissions.
30. IPCC Fifth Assessment Report, Summary for Policymakers, Table SPM.1, 2015, http://ar5-syr.ipcc.ch/topic_summary.php, accessed February 2018.
31. UNFCCC, Paris Agreement, 2015, Article 4 and preamble, page 2, https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf, accessed February 2018.
32. On August 4, 2017 the United States informed the United Nations regarding of its intent to withdraw from the Paris Agreement when permitted under the agreement in 2020. The announcement indicated that the U.S. would consider "re-engaging in the Paris Agreement if the United States can identify terms that are more favorable to it, its businesses, its workers, its people, and its taxpayers." United States Department of State, Communication Regarding Intent To Withdraw From Paris Agreement, August 4, 2017, <https://www.state.gov/r/pa/prs/ps/2017/08/273050.htm>, accessed February 2018.

33. As summarized in K. K. Ross et al., *Translating Targets Into Numbers: Quantifying the Greenhouse Gas Targets Of The G20 Countries*, World Resources Institute Working Paper (December 2016), https://www.wri.org/sites/default/files/Translating_Targets_into_Numbers.pdf, accessed February 2018. The WRI is a strong proponent of aggressive climate change policies that is supported by several European and American government agencies and foundations, and produces some of the most widely used summaries of subnational, national and global emission data in the world (see, e.g., <https://www.climatewatchdata.org/>). The institute believes that, "Climate change is an urgent threat to humanity that demands swift, decisive action" (<http://www.wri.org/our-work/topics/climate>, accessed February 2018.) The authors are cognizant of the polarized and politicized debate among scientists about the relative contribution of anthropogenic GHG emissions and other factors to climate change, and the severity, speed and probability of climate change consequences. The emissions data cited in this paper have been published by agencies and organizations that, like the WRI, view climate change as primarily caused by anthropogenic GHG emissions, and that catastrophic climate impacts will occur within a century or less unless urgent and dramatic emissions reductions are achieved.
34. According to the UNFCCC, "any process, activity or mechanism which removes a greenhouse gas from the atmosphere is referred to as a "sink". Human activities impact terrestrial sinks, through land use, land-use change and forestry (LULUCF) activities, consequently, the exchange of CO₂ (carbon cycle) between the terrestrial biosphere system and the atmosphere is altered." UNFCCC, Land Use, Land-Use Change and Forestry (LULUCF), <https://unfccc.int/topics/land-use/workstreams/land-use-land-use-change-and-forestry-lulucf>, accessed February 2018.
35. Environment and Climate Change Canada, 2017, Canadian Environmental Sustainability Indicators: Greenhouse Gas Emissions, www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=FBF8455E-1, accessed February 2018.
36. The website [Climateactiontracker.org](http://climateactiontracker.org) tracks compliance with the Paris Agreement for 32 countries that account for about 80% of global emissions. The organization's analyses are used by several media outlets, including the New York Times. For details on the effects of the country's revised 2017 NDC on its actual reduction commitments, see <http://climateactiontracker.org/countries/canada.html>, accessed February 2018 ("On 11 May 2017, Canada submitted its revised NDC. While the revision does not change Canada's NDC target, it states that Canada is examining its approach to accounting for emissions in the land use, land use change and forestry (LULUCF) sector. This is a departure from its original NDC submission, which stated that Canada would use a net-net. . . accounting approach for the LULUCF sector. . . . The emissions level from planned policies is equivalent to a 5% reduction from 1990 levels, excl. LULUCF and a 21% reduction from 2005 levels, excl. LULUCF.").
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38. GHG emissions tracking agencies and organizations use different methodologies for estimating GHG emissions. The PBL Netherlands Environmental Assessment Agency data provide a consistent accounting of global and national total GHG emissions, including non-carbon dioxide gases, that extends from 1990. The EU target year emissions in Figure 3 represent a 40% decline from the 1990 emissions reported by the PBL Netherlands Environmental Assessment Agency and may differ from other estimates of the EU's 2030 target emissions volumes.
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173. Compiled from U.S. Bureau of Labor Statistics, Current Employment Statistics, 2010-2017, Total Manufacturing Employment, Annual Averages (Not Seasonally Adjusted), extracted from <https://www.bls.gov/data/>, accessed March 2018.
174. The median incomes are shown in 2007 and 2016 dollars using American Community Survey incomes distributions for each year that the Census Bureau adjusts monthly for inflation within each year. Adjusted for inflation using the California Department of Finance methodology (see sources to Table 3.6), smaller income ranges show little to no real income change from 2007-2016 outside of the Bay Area.

175. See, e.g., Ellie Anzilotti, *The Reach of the Bay Area's 'Tech Buses'*, CityLab, Sep 16, 2016 <https://www.citylab.com/transportation/2016/09/the-reach-of-the-bay-areas-tech-buses/500435/>, accessed March 2018. Tens of thousands of Bay Area commuters are served by privately operated buses. The American Community Survey forms do not appear to distinguish between privately run or public bus transportation. See the journey to work questions in U.S. Census Bureau, American Community Survey (ACS), *Why We Ask: Commuting/Journey to Work*, <https://www.census.gov/topics/employment/commuting/guidance/commuting.html>, accessed March 2018.
176. Compiled for Bay Area and non-Bay Area locations from the 2007 and 2016 American Community Survey 1-Year Estimates, Table B08105 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.
177. Compiled for Bay Area and non-Bay Area locations from the 2007 and 2016 American Community Survey 1-Year Estimates, Table B08105 series, accessed through <https://factfinder.census.gov/>, accessed February 2018.
178. See Jennifer Hernandez, *California Environmental Quality Act and the Housing Crisis*, *Hastings Law Review*, Winter 2018, available at <https://www.hklaw.com/CaseStudies/Linking-CEQA-to-Californias-Housing-Crisis/>.
179. by Ben Johnson, *The Great Horse Manure Crisis of 1894*, *Historic UK History Magazine*, <https://www.historic-uk.com/HistoryUK/History-of-Britain/Great-Horse-Manure-Crisis-of-1894/>, accessed April 2018.
180. Regional Council of the Southern California Association of Governments (SCAG), *2012-2035 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS): Towards a Sustainable Future*, April 4, 2012, <http://rtpscs.scag.ca.gov/Pages/2012-2035-RTP-SCS.aspx>, accessed April 2018. The Final Program Environmental Report for the 2012-2035 RTP/SCS (April 2012) is located at <http://rtpscs.scag.ca.gov/Pages/Final-2012-PEIR.aspx>, accessed April 2018.

Design Notes

CALIFORNIA, GREENHOUSE GAS REGULATION, AND CLIMATE CHANGE utilize the following:

To achieve visual harmony a modified version of the grid Jan Tschichold conceived for his book *Typographie* was employed.

MINION PRO Chapman's serif family, is a digital typeface designed by Robert Slimbach in 1990 for Adobe Systems. The name comes from the traditional naming system for type sizes, in which minion is between nonpareil and brevier. It is inspired by late Renaissance-era type.

FUTURA is Chapman's geometric san-serif family designed by Paul Renner and released in 1927. Despite its clean geometric appearance, some of Futura's design choices recalled classic serif typefaces. Unlike many sans-serif designs intended for display purposes, Futura has quite a low x-height, reducing its stridency and increasing its suitability for body text. Futura has an appearance of efficiency and forwardness. Source: Wikipedia

Front and back cover: www.123RF.com

All interior photos www.123RF.com

Book exterior and interior design by Chapman University professor Eric Chimenti. His work has won a Gold Advertising Award, been selected for inclusion into *LogoLounge: Master Library, Volume 2 and LogoLounge Book 9*, and been featured on *visual.ly*, the world's largest community of infographics and data visualization. He has 27 years of experience in the communication design industry. To view a client list and see additional samples please visit www.behance.net/ericchimenti.

Professor Chimenti is also the founder and head of Chapman's Ideation Lab that supports undergraduate and faculty research by providing creative visualization and presentation support from appropriately qualified Chapman University undergraduate students. Services include creative writing, video, photography, data visualization, and all aspects of design. The students specialize in the design and presentation of complex communication problems.



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DEMOGRAPHICS & POLICY
RESEARCH BRIEF

...the imposition by the state's Democratic party leaders of highly regressive climate schemes have engendered disparate financial hardships on middle and lower income workers and minority communities, while providing direct economic subsidies to wealthier Californians in environmentalist strongholds like Marin County.



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