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An Economic Imperative: Climate Action in the Golden State

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The Leslie and Susan Gonda (Goldschmied) Foundation





About this Report

This report reviews and compares the damage to California's economy from recent climate-related disasters and risks from future unabated climate change to the potential impact specific climate action policies could have on job and economic growth in the state's core industries. The report uses publicly-available information and data from previous E2 analysis, BW Research, state and federal agencies, University of California system, and other reports.

Acknowledgments

We want to express our sincere gratitude to the Leslie and Susan Gonda (Goldschmied) Foundation who generously provided underwriting for this report. The Foundation is committed to addressing climate change by educating communities about the tremendous economic and environmental benefits of climate solutions, and the dire costs of inaction.

Special thanks to Clint Wilder, Kai Diep, and the California staff at the Natural Resources Defense Council.

About E2

E2 (Environmental Entrepreneurs) is a national, nonpartisan group of business leaders, investors, and professionals from every sector of the economy who advocate for smart policies that are good for the economy and good for the environment. E2's more than 10,000 members and supporters work and do business in every state in the country, coming from diverse business backgrounds ranging from clean energy and clean tech to real estate and finance and beyond.

Our members have been involved in the financing, founding or development of more than 2,500 companies that have created more than 600,000 jobs, and manage more than \$100 billion in venture and private equity capital.

California is already suffering dire economic impacts from the effects of climate change, presenting significant business and economic risk to the world's fifth largest economy. The costs of extreme climate events such as wildfires and droughts have risen steadily throughout the past decade, and are projected to increase dramatically in California if current trajectories continue. These costs are being borne by everyone who lives, pays taxes, buys insurance, or works in California.

At the same time, aggressively addressing climate change — reducing greenhouse gas emissions while growing the state's clean energy economy — presents one of the greatest economic opportunities of the 21st century. Ambitious climate action produces robust job creation, sustainable economic growth, and California leading global innovation across a wide range of industry sectors. Members of Congress can seize this opportunity by passing the Biden administration's Build Back Better plans anchored in clean energy investments; California lawmakers must build on existing state climate policy leadership to ensure the state remains a nexus of investment and innovation in the 21st century economy.

By the Numbers

\$55 billion

Direct property damage from California wildfires, 2017–2020

\$47 billion

Economic activity in California's clean ocean economy under threat from sea level rise and ocean warming

\$50.5 billion

Overall production value of California's 77,500 farms, which now face regular threats from droughts and other climate change-related impacts

484,980 jobs

Nearly a half million Californians are employed in the clean energy economy, representing 28% of the state's construction workers and 3% of California's economy-wide workforce

#1 export

Electric vehicles were the state's most valuable export in 2020, producing nearly \$5.7 billion in revenue

The staggering costs of climate change in California are hard to project precisely because they're growing every year in both geographic reach, public health impact, and dollar amount. But an examination of just four major climate impacts — wildfires, sea level rise, ocean warming and drought — shows how climate change is draining billions of dollars from the state's economy, with far worse to come without climate action.

Wildfires

California suffered four of its worst wildfires in history from 2017 to 2020, costing \$55 billion in direct property damage¹ and far more from the health effects from the resulting air pollution and fire disrupted supply chains. Pacific Gas & Electric's 2019 bankruptcy is illustrative of the business risk presented by climate exacerbated wildfires. These fires also caused "reverse tourism" — people fleeing fire and smoke or not visiting areas because of it — in the nation's biggest tourism state. In Santa Cruz County, where tourism is a \$1 billion annual business, visitors were asked to leave at the peak of the summer travel season in August 2020 to free

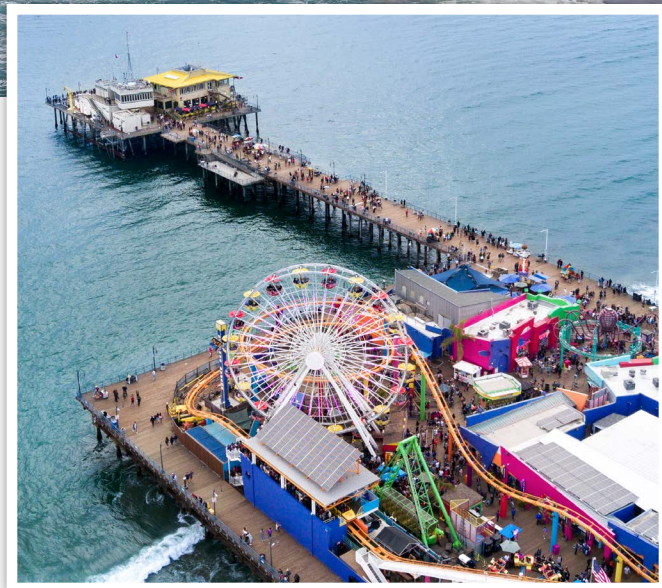
up hotel rooms for local wildfire evacuees and out-of-area firefighters. Looking forward, more travelers — and their leisure dollars — will simply avoid California during peak wildfire season to steer clear of both fires and smoky, unhealthy air.

The high cost of living, one of myriad reasons why California saw the first population drop in its 170-year history in 2020, are being driven even higher by rising home insurance rates. The wildfires of 2018 cost insurers \$24 billion. Relatedly, insurers refused to renew 235,250 home insurance policies in California in 2019², a 31 percent increase from the prior year. In ZIP codes that had a moderate to very high fire risk, non-renewals increased 61 percent.

Gov. Gavin Newsom has set aside more than \$80 million in emergency funds for an additional 1,400 firefighters in 2021.³ This is in addition to California spending billions of dollars of public funds on fire prevention and clean up over the last decade; additionally, ratepayers are spending billions more on grid hardening, driving up utility bills. Over the past decade, annual state government costs for emergency firefighting have increased more than tenfold — from \$90 million to \$1.3 billion.⁴

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Sea Level Rise and Ocean Warming

Rising sea levels in the 21st century constitutes an existential threat to the California economy. According to a 2019 USGS report⁵, the cost of sea level rise could inflict 10 times the amount of economic damage to our state's economy as wildfires and earthquakes combined.

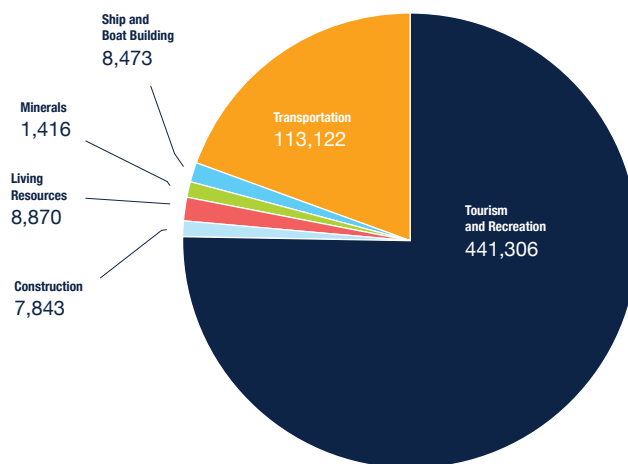
California's clean ocean economy — vibrant and robust — has a lot to lose from the impacts of a changing climate. Including tourism and recreation, commercial fishing, and construction but excluding oil and gas, the state's clean ocean economy is a \$47 billion sector employing over 580,000 Californians whose jobs depend on a healthy ocean. Of those workers, more than 440,000 work in ocean tourism and recreation, a \$26.5 billion industry.⁶

Rising seas also threaten critical coastal infrastructure. A key Southern California rail corridor, for example, requires \$100 million in coastal bluffs reinforcement until new tracks can be built inland. Moving the tracks is expected to cost another \$3 billion.⁷

Ocean warming is also contributing to toxic algal blooms that make seafood unsafe to eat — severely impacting the state's fishing industry. Algal blooms in recent years have delayed and shortened the season for Dungeness crabs, the most valuable sector of West Coast fisheries accounting for 26 percent of fishery revenue.⁸

California Clean Ocean Economy Employment

Employing over 580,000 Californians, the vibrancy and productivity of the state's clean ocean economy is at risk from climate change.



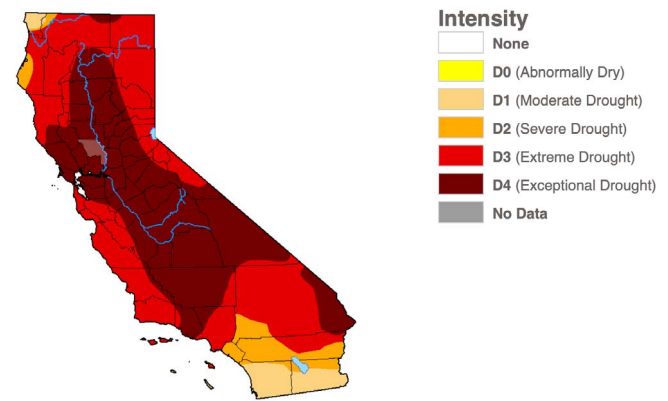
Source: National Ocean Economics Center, 2018

Drought

Climate change is creating a new normal of extreme weather in California, with longer periods of below-normal precipitation along with higher temperatures. In addition to being a significant contributor to wildfires, California's climate change-exacerbated drought conditions are significantly impacting the state's agriculture, fishing and tourism industries, along with other businesses that depend on a reliable water supply. Notably, these recent drought conditions are causing the state's vast agriculture industry to adapt to a future with less water.

California is America's most productive agricultural state in the country representing 13.5 percent of the nation's agricultural industry⁹, producing more than 400 agricultural commodities, collecting billions in cash receipts, and supporting hundreds of thousands of jobs statewide.¹⁰ But much of California's industrial agriculture is unsustainable, with groundwater extraction at levels that have depleted aquifers and have caused the land to sink (known as subsidence). As climate change impacts become more frequent and intense (both extreme drought and heat), California will experience reduced crop yields and conditions that make it infeasible to grow many crops that are currently grown in California. Estimates predict that this new normal will hit the state's agricultural economy hard and necessitate a reduction of irrigated land by 10-15 percent and a 10 percent reduction of farm employment over the coming decades.¹¹

California Drought Map, August 2021



Source: National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration

Furthermore, an analysis by the University of California determined that by 2050, climate change will render the San Joaquin Valley no longer suitable for growing crops like apricots, peaches, plums and walnuts.¹² Diversifying the economy in the Central Valley is essential, in order to create new jobs and sustain communities while transitioning to a more sustainable agricultural model, including regenerative agricultural practices.

As of August 2021, more than 95 percent of the state is experiencing severe drought, with conditions that are expected to be longer, drier, and hotter than droughts in the past. The current drought highlights the challenges facing the agricultural economy in adapting to climate change, including significantly reducing water use.



California's Oroville Dam with significantly reduced water levels

The economic threat from climate change is immense, but the opportunity to secure economic benefits from aggressive climate action — transitioning and creating a sustainable economy — is great. With legislation such as Assembly Bill 32, the Global Warming Solutions Act of 2006, California's climate policy leadership has helped create the market structures necessary to nurture the creation of a leading clean energy economy. Thanks in part to smart public policy, almost a half-million Californians — including electricians, HVAC technicians, solar and wind installers and electric vehicle assemblers — work throughout the state's economy, from construction and manufacturing to energy and finance.

With its strong legacy as a world nexus of entrepreneurship, technology innovation, and supportive public policy and investment, California is in a strong position to build on this success and create the 21st century products and services that power a low-carbon, clean energy economy — for California and beyond.

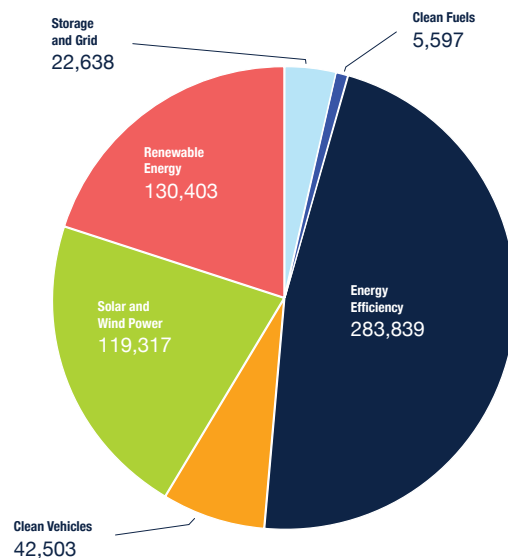
Six clean energy economy subsectors are illustrative of the economic payoff awaiting California: electric powered transportation (manufacturing of vehicles and the charging infrastructure ecosystem), solar energy and storage, offshore wind energy, geothermal energy, production of lithium-ion batteries for electric vehicles and electricity storage, and electrification of buildings.

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California Clean Energy Economy Employment

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Source: Clean Jobs America 2021

Transportation Electrification

Key subsectors for California:

- Manufacturing of passenger electric vehicles (EVs), electric buses and trucks, and their components
- EV charging infrastructure (charging stations and grid integration)

More than 40,000 Californians work in clean vehicle jobs, including in electric and hybrid vehicle manufacturing, repair, and maintenance, along with wholesale trade and professional services in California's core EV industries. Notably, this does not capture jobs associated with EV charging infrastructure, a large and growing industry. Tesla alone has grown to be one of the state's largest manufacturing employers, with about 10,000 jobs at its largest plant in Fremont. The state's EV workforce is projected to nearly double by 2024.¹³

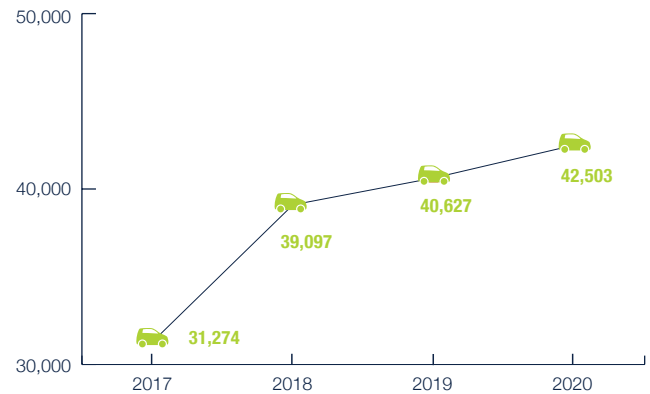
In 2020, EVs were the state's most valuable export, producing nearly \$5.7 billion in revenue and eclipsing California's venerable aerospace industry for the first time.¹⁴ Furthermore, this growth has supported high quality jobs; the average wage in California's EV ecosystem is 33% higher than the state's average wage.¹⁵

With California representing 47 percent of the U.S. market for plug-in EVs, building out a robust EV charging infrastructure is both a job creator and a necessity. In an extremely competitive global market that includes corporate titans like ABB, Siemens, BP, and Shell, California's ChargePoint (based in Campbell) is the world leader with some 115,000 charging stations across North America and Europe. Los Angeles-based EVgo operates the largest network of fast chargers in the U.S.

In January, Gov. Newsom set a goal of installing 250,000 EV chargers (including 10,000 direct current fast chargers) in the state by 2025. California (as of April 2021) has over 73,000 chargers installed, including over 6,000 fast chargers, with an additional 121,000 planned.¹⁶

California Clean Vehicle Employment Growth, 2017-2020

California's EV ecosystem is a global leader and poised to capitalize on additional job growth.



Source: Clean Jobs America 2021

California state policies have helped build a healthy EV ecosystem, and the sector's next big opportunity is zero-emission medium and heavy-duty trucks and buses. In 2020, the state adopted the world's first zero-emission truck and bus requirement, the Advanced Clean Trucks rule, requiring manufacturers to sell an increasing number of clean, zero-emission trucks and busses in California. Two of the world's largest electric bus manufacturers, China's BYD (with U.S. headquarters in Los Angeles) and Burlingame-based Proterra, both operate factories in Los Angeles County. Michigan-based Meritor makes electric powertrain kits for heavy-duty EVs in Escondido, one example of the important and growing link between California and Detroit in the EV industry.

California is also in a potentially great position to capitalize on demand for lithium, the key resource in lithium-ion batteries; we discuss this opportunity in the lithium-ion battery section on page 8.

“ — In 2020, EVs were the state's most valuable export, producing nearly \$5.7 billion in revenue ”

Solar Energy and Storage

California is home to more than 2,000 companies in the solar industry and solar power now supplies more than 20 percent of the state's electricity. California's inland rural areas, with abundant sunshine and wide-open spaces, have seen notable job creation from solar. As an example, the 200-megawatt Garland Solar Project in Kern County created 570 construction jobs, with more than half of the employees from communities located within 50 miles of the project. The Garland project generated \$25.7 million in tax revenue for Kern County and \$16.9 million for the state.¹⁷ In fact, the congressional district with the most installed solar capacity in the U.S. (as of 2018) is represented by Republican House Minority Leader Kevin McCarthy, with more than 2,400 megawatts installed.¹⁸ As the impacts of climate change drive the retirement of California agricultural land, farmers can offset lost agricultural revenue by converting land to solar production and capitalizing on California's clean energy revolution.

California has the highest cumulative solar capacity in the entire U.S. as of 2021, with more than 30,000 megawatts installed, more than three times more than the second-ranked state, Texas.¹⁹ Compared to natural gas plants that have ongoing fuel costs, a larger share of solar project costs go into local jobs. Solar projects support 60 local jobs for every

megawatt built, according to the California Solar and Storage Association. One out of every 143 California jobs are now in solar energy.²⁰

Offshore Wind Energy

California pioneered the U.S. onshore wind power industry in the 1980s and 1990s; now offshore wind is poised to be the next big thing in clean energy for the state. The sector received a huge boost in May when the Biden administration opened the West Coast to offshore wind developers, paving the way for leases off the Humboldt coast and near Morro Bay on the central coast. Gov. Newsom's 2021-22 budget includes \$20 million to jump-start the sector, including \$11 million to examine manufacturing feasibility in the economically hard-hit Humboldt County port city of Eureka.

Because of wind turbine blades' gargantuan size and high transportation costs, manufacturing the blades near their deployment is paramount in the industry — the manufacturing opportunity exists not just for coastal communities, but Central Valley communities along the state's Bay Delta. Floating offshore wind farms in the Pacific can become a significant job creator, adding up to \$48 billion to the State's gross domestic product, 26,000 annual construction jobs, and nearly 6,000 long-term operations and maintenance jobs through 2050.²¹



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Geothermal Energy

California is the largest producer of geothermal power in the U.S., with 40 plants generating nearly 6 percent of the state's electricity in 2020; the Geysers geothermal plant complex in Lake and Sonoma Counties is the largest in the world. Total U.S. geothermal generating capacity has grown by an average of less than 2 percent annually for the past three decades²², but as California quickly moves to meet its aggressive 100 percent clean electricity mandate by 2045, the geothermal industry's clean firm power is enjoying a resurgence. California is taking advantage of its plentiful geothermal resources, with the first new plants in nearly a decade under construction in Imperial and Mono Counties.

Production of Lithium-ion Batteries

Existing geothermal operations at the Salton Sea offer the opportunity for a new, breakthrough sector in the California clean energy economy: lithium extraction. Geothermal brine (a byproduct of geothermal generation) is rich in lithium, the essential resource in the millions of lithium-ion batteries that supply power to EVs and store electricity for homes and the electric grid. More than 90 percent of the world's lithium comes

from China and three other countries and is often mined with environmentally destructive practices. If extracted responsibly, the Salton Sea could meet 40 percent of world lithium demand with less ecological and public health impact than current sources²³, create a local source for California's EV and battery makers and provide badly needed job creation and economic development in the Imperial Valley.

Building Electrification

Nearly 50 California cities, including San Jose, San Francisco, Sacramento, San Luis Obispo, and Carlsbad, have enacted ordinances that require or strongly encourage new buildings, residential and commercial, to be all or partially electric.²⁴ This trend will continue as we move toward 2045 and the California Energy Commission and Public Utilities Commission have an opportunity to accelerate building electrification through Title 24 and market transformation and retrofit programs. The labor needed to electrify all of California's existing and new buildings would require more than 100,000 full time workers in the construction industry and up to 4,900 full-time manufacturing workers.²⁵



California has been a global climate leader by passing policies that have created the market structures necessary to build the state's clean energy economy, drive innovation, and mitigate carbon emissions. But to continue to grow that economy, the state and federal government must do more. California's climate policy leadership can also reap in-state benefits from beyond our borders as it serves as a proving ground for world climate action, while also expanding national and global markets for California-made technologies.

State Leadership

To capture these economic benefits and maintain a position as a world leader and climate-tech innovation hub, California must codify our state's carbon neutrality goals while tightening our emissions mitigation targets. To reach these goals, the state must advance sector-specific policy to further decarbonize our economy. We need state policy leadership that:

- Accelerates our transition to a zero-carbon electric grid, including advancing our nascent offshore wind industry and supporting the development of clean firm power.
- Electrifies our transportation system, including the passage of a strong Advanced Clean Fleets rule and policies that ensure there is adequate funding to drive robust and equitable adoption of passenger electric vehicles and the infrastructure to charge these electric vehicles.
- Decarbonizes our state's building stock; reducing policy and market barriers to electrify buildings coupled with strong electrification policies are essential to addressing carbon emissions in our built environment, the state's second largest emitter of GHGs.
- Drives innovation to decarbonize our industrial sector. An exciting opportunity exists to advance low-carbon cement and concrete technology, including storing captured carbon in concrete products.
- Sets standards and reporting requirements to ensure financial markets properly assess climate-related risks.

- Incentivizes and supports farmers and ranchers to transition to regenerative agricultural practices to reduce carbon emissions and sequester carbon in soil.

Federal Leadership

While state policy leadership is essential, federal leadership is needed to avoid catastrophic climate change and avoid the severe economic impacts it will bring. Smart federal policy is also needed for California to realize the full economic opportunity presented by climate action.

The Biden administration's Build Back Better plans present an opportunity for the federal government to help restore the global competitiveness of our economy and leverage the clean energy economy to drive investment in America's and California's future. Congress can do so by:

- Passing and funding legislation to create a national car-charging network, expand building efficiency and decarbonization, and modernize our electric grid.
- Improving the length and accessibility of federal tax incentives for energy efficiency, clean energy, and zero-emission vehicles and infrastructure.
- Passing national standards to put utilities on a path to 100 percent clean energy by 2035.
- Increasing federal investments in research and development as well as in procurement of clean energy, vehicle and battery storage, energy efficiency, and regenerative and low-carbon agriculture to spur innovation.
- Creating new clean energy workforce programs and better funding existing programs to enhance clean energy training opportunities and improve equity to help meet the workforce requirements of a better, cleaner economy.
- Funding the National Clean Energy and Sustainability Accelerator to leverage private capital, enhance financing of climate-smart projects and address equitable access to clean energy funding for climate-impacted communities and businesses.

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