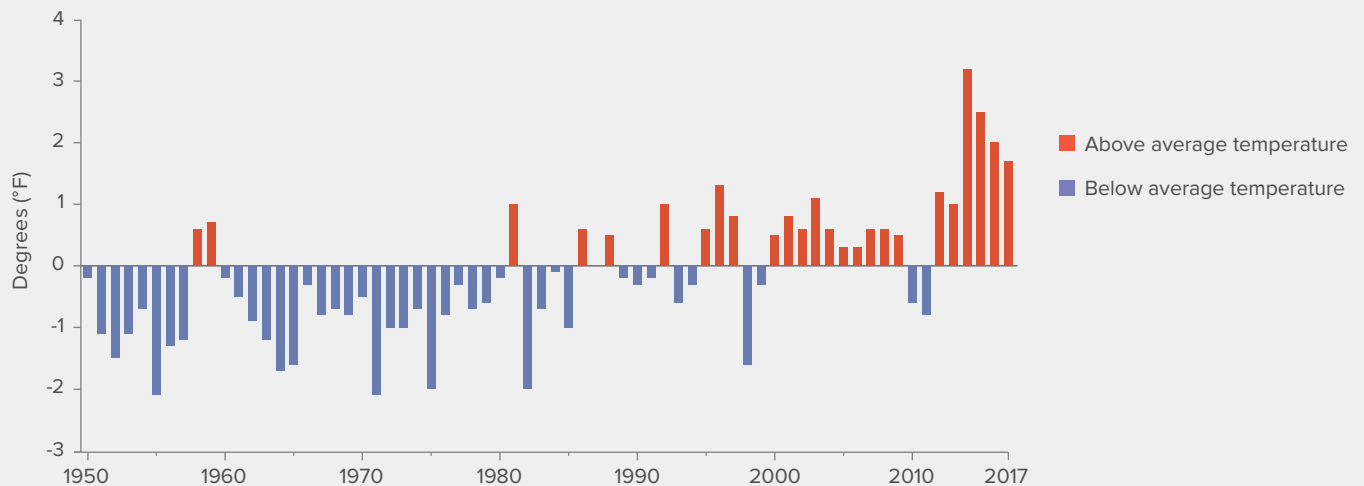


### Climate change threatens California's future

Global emissions of greenhouse gases (GHGs) are raising air and water temperatures as well as sea levels, with serious consequences for California. The state has recently experienced record-high temperatures, and warming is expected to continue over the century. The sea level is predicted to rise 12 to 55 inches by 2100 in California's most populated coastal regions, and the frequency of extreme events such as droughts, heat waves, wildfires, and floods is expected to increase. Higher temperatures result in more precipitation falling as rain (and less as snow), which will increase both the frequency and magnitude of flooding and diminish water reserves in the Sierra snowpack. Even if all GHG emissions ceased today, some of these changes would be unavoidable because the climate system changes slowly.

#### CALIFORNIA IS GETTING WARMER



SOURCE: National Oceanic and Atmospheric Administration.

NOTES: The figure shows degrees above or below the average statewide temperature (58.3°F) from 1981 to 2000. The 2017 value is an estimate—based on the average monthly temperature of January to October 2017, departing from the average temperature for the same months in the 1981–2000 period (60.6°F).

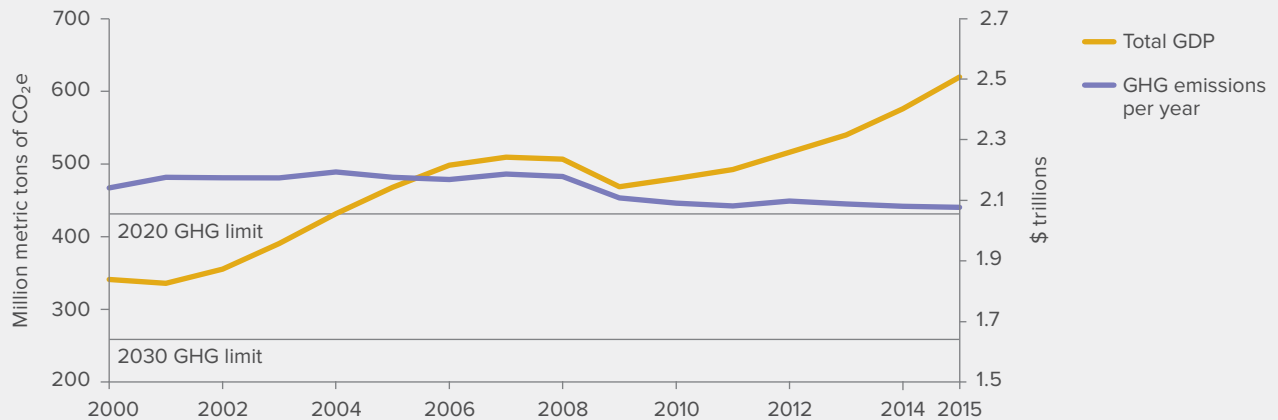
In the face of these threats, California has emerged as a leader in global efforts to reduce GHG emissions. In 2006, California enacted Assembly Bill (AB) 32, the Global Warming Solutions Act, which requires the state to reduce GHG emissions to 1990 levels by 2020. In 2016, the enactment of Senate Bill (SB) 32 extended this commitment by raising the emission reduction target to 40 percent below 1990 levels by 2030. And an executive order calls for GHG emissions to be reduced to 80 percent below 1990 levels by 2050. The July 2017 PPIC Statewide Survey found that two in three Californians favor the state's emission reduction goals.

Reductions of this magnitude are needed on a global scale to stabilize the earth's climate. California faces a twofold policy challenge: finding cost-effective ways to reduce GHG emissions and preparing for the climate changes that are expected even if emissions are reduced.

### California is using a multifaceted approach to reduce emissions

According to the California Air Resources Board (CARB), which is responsible for implementing the Global Warming Solutions Act, California is on track to meet the 2020 emissions target. CARB recently updated its Scoping Plan to establish a framework for meeting the 2030 target. Laws enacted in 2015, 2016, and 2017 take steps in this direction. The initial Scoping Plan, adopted in late 2008, was the first comprehensive plan of its kind within the United States (and one of the first such plans internationally).

## CALIFORNIA'S ECONOMY IS GROWING DESPITE REDUCTIONS IN GHG EMISSIONS



SOURCES: California Air Resources Board (emissions) and US Bureau of Economic Analysis (GDP).

NOTES: Gross domestic product (GDP) is expressed in 2016 dollars. GHG emissions are in millions of metric tons of CO<sub>2</sub> equivalent (CO<sub>2</sub>e), a measure used to compare the relative contribution to global warming of various greenhouse gases. The CO<sub>2</sub>e of CO<sub>2</sub> is 1, while the CO<sub>2</sub>e of methane is 25.

- **Reducing transportation emissions is key.**

Although transportation emissions have been reduced by 10 percent since the early 2000s, this sector is still California's largest GHG source (39% in 2015). Policies to reduce GHGs include low-carbon fuel standards that aim to lower the carbon intensity of fuels by 10 percent by 2020; a plan to add 1.5 million zero emission vehicles—or electric vehicles—to roadways by 2025; SB 375, which would reduce vehicle miles traveled by integrating land-use and transportation investments; and a plan to reduce emissions from public transit and freight vehicles.

- **The state is increasing its reliance on cleaner energy.**

California's Renewables Portfolio Standard requires power utilities to provide 33 percent of total electricity from renewable energy sources by 2020. In 2015, SB 350 raised this target to 50 percent by 2030. The state is on track to meet the 2020 goal—more than 25 percent of electricity came from renewable sources in 2016—but achieving the goal for 2030 will require additional shifts away from natural gas as a power source.

- **A statewide cap-and-trade program brings flexibility to efforts to reduce GHG emissions.**

California was the first state to enact a GHG cap-and-trade program. Adopted in 2011, the program was recently extended to 2030. By allowing businesses to trade emissions permits, cap and trade allows market forces to help determine the cost of reducing emissions. Permit auctions now cover 85 percent of the state's GHG emissions. The auctions began in 2012 with electric utilities and large industrial emitters; transportation and heating fuels were added in 2015.

- **New policies target methane and other potent GHGs.**

Short-lived hydrofluorocarbons (HFCs)—methane, black carbon, and most fluorinated gases—are powerful climate-warming gases and harmful air pollutants. Together, they account for more than 13 percent of all GHG emissions, with methane the largest source at 9 percent. SB 1383 (enacted in 2016) mandates cutting methane and HFCs by 40 percent and black carbon by 50 percent below 2013 levels by 2030, following a strategy proposed by CARB. The proposal could significantly affect California's dairy industry, which is responsible for more than half of the state's total methane emissions.

- **Forests, farms, and wetlands provide opportunities to capture and store carbon.**

Carbon dioxide can be removed from the atmosphere by plants and stored in vegetation or in soils. The state is developing a strategy to align traditional environmental and economic benefits of natural and working lands with potential carbon storage, using integrated land-use approaches.

## California needs to prepare for the effects of climate change

California is ahead of other states in developing information on the effects of climate change, but more work is needed to prepare for these changes.

## SEA LEVEL RISE THREATENS THE BAY AREA



SOURCES: Map from San Francisco Bay Conservation and Development Commission; inundation data from N. Knowles, "Potential Inundation Due to Rising Sea Levels in the San Francisco Bay Region" (California Climate Change Center, 2009).

NOTE: The map illustrates the potential inundation with 16 inches and 55 inches of sea level rise, toward the upper end of the range expected by 2050 and 2100, respectively.

- **The effects of climate change are already evident.**

The mountain snowpack is melting earlier; the spring 2015 snowpack was the lowest on record. Average annual temperatures are rising and wildfires are increasing. Warming and more severe droughts are threatening some plants and animals with extinction.

- **Air quality will worsen and extreme events will increase.**

Rising temperatures will increase the intensity and spread of smog, likely requiring additional pollution controls to meet air quality standards. An increase in extreme events—heat waves, wildfires, and floods—will also threaten public health and challenge the state's health care and emergency preparedness systems.

- **Sea level rise threatens coastal infrastructure, homes, and habitat.**

The Pacific Institute found that 55 inches of sea level rise (near the higher end of projections for 2100) will put almost half a million residents at high risk of flooding and threaten critical infrastructure, including airports, power plants, sewage treatment plants, and 3,500 miles of roads. Risk prevention plans that also protect coastal ecosystems are needed.

- **Water management faces challenges.**

The shrinking mountain snowpack reduces water storage and increases the risk of Central Valley flooding. Rainfall variability is also expected to increase, leading to more-intense droughts and floods. Sea level rise and floods increase risks to the Sacramento–San Joaquin Delta's fragile levees, which are important for the state's water supply. The 2017 crisis at Oroville Dam highlighted the risks from aging infrastructure, designed to function in a past climate.

- **Agriculture will have to adapt to changing conditions.**

Reduced water supply reliability and higher temperatures will pose challenges for crop management. Research on heat- and drought-tolerant crops and tools such as localized climate information can help farmers adapt.

- **Native biodiversity is under threat.**

Climate change places an added burden on many plants and animals. As temperatures rise, many species will need to migrate to more hospitable areas, but development patterns could hinder this movement. During the latest drought, hot, dry conditions—similar to those expected in future droughts—put 18 native fish species at high risk of extinction.

- **Readiness to cope is variable.**

Water and electric utilities have begun to factor climate change into their long-range planning strategies, the state has developed an adaptation strategy for its agencies, and some local and regional governments are developing adaptation plans. But in areas such as ecosystem management and flood control, institutional and legal frameworks are ill-equipped to prepare for change.

- **The state is providing online adaptation tools for local governments.**

Cal-Adapt, the California Adaptation Planning Guide, and the California Local Energy Assurance Planning Tool can help local governments understand their vulnerabilities and prepare for change.

- **Californians support action to address climate change effects.**

In the July 2017 PPIC Statewide Survey, 72 percent of Californians supported the goal of cutting emissions to 40 percent below 1990 levels by 2030. Residents favor efforts to reduce warming even though most expect them to increase gas prices.

## Looking ahead

California is on track to meet its emission reduction goals for 2020 and has begun to take actions to meet the more ambitious goals for 2030 and beyond. But California only produces about 1 percent of global emissions. Recent federal policy shifts on

energy and climate change are heightening uncertainty in the international arena, and even if efforts such as the 2015 Paris Agreement prove successful, California must prepare for some inevitable effects of climate change.

**Achieve near-term greenhouse emission reductions.** Large reductions are needed soon to avoid the most severe effects of climate change.

**Undertake some “no regret” measures now to reduce the effects of climate change.** For example, considering climate change in current land-use planning could facilitate migrations of species. Limiting development in flood-risk areas will avoid future costs.

**Review adaptation plans for critical infrastructure.** Incidents like the Oroville Dam crisis in early 2017 highlight the importance of assessing the impact of a changing climate on critical infrastructure. For infrastructure such as dams and power plants, response plans and funds for upgrades are required to protect public safety and maintain reliable services.

**Spend cap-and-trade revenues in priority areas.** Cap-and-trade auctions have made large sums available for programs to reduce GHG emissions. As of August 2017, roughly \$800 million is available from previous auctions, and revenues for 2017–18 are expected to reach \$2.5 to \$3 billion. Some of these funds are earmarked for programs in economically disadvantaged areas. Other priorities should include innovative projects with limited access to other funding, such as improving forest management to store carbon and helping dairies transform methane into electricity with bio-digesters.

**Continue to play a leadership role.** California’s new GHG emissions targets for 2030 reinforce the state’s commitment to combating climate change and encourage other governments to take action. California can also help lead global efforts by sharing information on successful innovations to reduce emissions.

## CONTACT A PPIC EXPERT



Alvar Escriva-Bou  
escriva@ppic.org



Brian Gray  
gray@ppic.org



Ellen Hanak  
hanak@ppic.org



Jeffrey Mount  
mount@ppic.org

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Public Policy Institute of California  
500 Washington Street, Suite 600  
San Francisco, CA 94111  
T 415.291.4400 F 415.291.4401  
**PPIC.ORG**

PPIC Sacramento Center  
Senator Office Building  
1121 L Street, Suite 801  
Sacramento, CA 95814  
T 916.440.1120 F 916.440.1121



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