

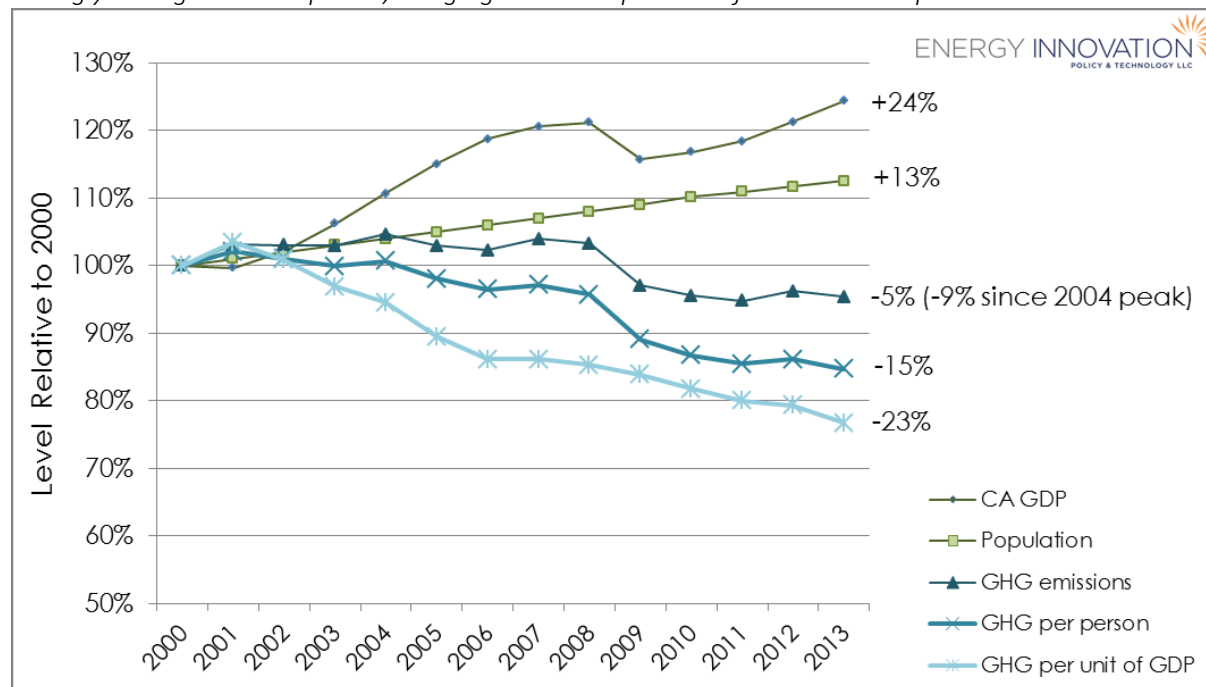
THE CALIFORNIA CLIMATE AND CLEAN ENERGY POLICY STORY

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World leaders are gathering in Paris to determine the best ways to reduce carbon emissions dramatically without jeopardizing the path to prosperity. In considering all the options, it is worthwhile to understand the California story, which offers an exceptional model—driven by smart policy. Of course, California is by no means done with this work, but the state has made great progress, and has further ambitious plans under development.

In California, greenhouse gas emissions are down. The state’s economy is growing robustly—much more strongly than the U.S. as a whole—and it is producing the clean tech innovations increasingly demanded the world over. California is a standout example of real world progress toward decarbonized prosperity. Figure 1 shows that the state has successfully decoupled emissions and economic growth.

Figure 1. Economic and Greenhouse Gas Trends in California. Since 2000, emissions reductions have outpaced steady population growth, driving down per capita emissions by 15 percent. GDP has grown strongly during the same period, bringing emissions per unit of GDP down 23 percent.



Source: Energy Innovation graphic using data from the following sources: (1) State GDP from the Bureau of Economic Statistics of the US Department of Commerce, (2) Population data from the California Department of Finance, and (3) Emissions data from the California Air Resources Board.

California’s experience offers reason for optimism that the battle to reduce greenhouse gas (GHG) emissions can be won—with the right leadership, policies, and technologies. This success so far is one reason why this past year Governor Jerry Brown put in place a [2030 target](#) to reduce economy-wide emissions by 40 percent below 1990 levels, part of a suite of [initiatives](#) strengthening California’s climate and energy policy framework.

1. CALIFORNIA’S POLICY APPROACH

California’s Assembly Bill 32 (AB 32), or the Global Warming Solutions Act, provides the overarching legal framework for the state’s efforts. Passed in 2006, AB 32 set the first economy-wide GHG limit in the Western Hemisphere. It requires statewide GHG emissions to return to 1990 levels by 2020. AB 32 gives the California Air Resources Board (CARB) primary responsibility for managing the attainment of this goal and requires it to develop a policy blueprint for getting there. The law requires CARB to update this blueprint, known as the Scoping Plan, every five years.

Figure 2. AB 32 was a bipartisan effort, reflected in the signing ceremony pictured here. (Photo [source](#))



1.1 A FOUNDATION OF PERFORMANCE STANDARDS

Performance standards for energy sources and end-use technologies make up the foundation of California’s policy approach. Roughly 80 percent of the state’s emissions reduction is expected to come from these standards, plus targeted incentives, financing support, and labeling or informational steps, which CARB refers to as “complementary policies” to the state’s cap-and-trade program.

Performance standards require the covered entity to achieve particular outcomes, such as a minimum required level of renewable energy in the electricity delivered by utilities or the maximum allowable level of greenhouse gas emissions per mile driven for passenger cars. While requiring a performance outcome, the method for achieving the outcome is flexible. Performance standards can be met through diverse technologies. This technological flexibility encourages creative, least-cost solutions. If there is a more cost-effective way to comply, companies have an incentive to choose the less expensive approach.

The Low Carbon Fuel Standard is an example of a performance standard that CARB has developed under AB 32 authority. It requires fuel suppliers to provide steadily cleaner transportation fuels. By 2020, the

rule calls for transportation fuels to achieve a 10 percent reduction in the carbon intensity below the 2010 level.

Many of the state's performance standards were put in place before AB 32, such as the state's building and appliance codes, which were pioneered in the 1970s. Building energy codes help to address a market failure known as "split incentives" between tenants and owners. The problem with rental buildings is that the people that usually pay the bills (the tenants) neither decide how energy efficient it is, nor choose the major energy-using appliances like refrigerators or water heaters. Building owners have an incentive to provide lower quality, inexpensive capital that uses more energy even though tenants would prefer energy-efficient capital that is costlier upfront for the building owner, but save money on future energy bills.

California's building codes illustrate another outstanding policy design innovation: continuous improvement. The California Energy Commission (CEC) evaluates the building energy codes every three years, automatically tightening them to reflect newly cost-effective options. Another example of continuous improvement is the [California Solar Initiative](#). This rebate program, which supports the adoption of PV systems, was designed with stepwise decreases in the size of the rebate in sync with deployment thresholds. These rebates have now expired, as planned.

1.2. A BROAD CARBON PRICE

Overlaying the state's complementary policies is a broad [cap-and-trade program](#) that provides a nearly economy-wide price on carbon. In 2006, [Sir Nicholas Stern](#) bemoaned the lack of a price on carbon emissions, calling this "the greatest market failure of all time." In addition to being a strong investment signal, the cap-and-trade program has motivated a detailed facility-level inventory of carbon emissions under its mandatory reporting rule. This empirical data foundation will be important for fine-tuning the program.

Through the auctioning of tradable permits, an incidental benefit of the program is that it provides a highly efficient form of revenue to the government. The state is using this revenue to underwrite deeper decarbonization, mitigate dislocations, and ensure climate policy's net effects enhance social equity. To create greater market certainty and as a step against setting caps at too high a level, a carbon price floor at auction was set at \$10 per ton of carbon dioxide equivalent in 2012, rising at a rate of five percent plus inflation per year, up to \$12.10 today. In practice, the auction settlement price has been near, but not at, the floor. The program also allows participants to borrow and banks to smooth out annual price fluctuations and to avoid very high prices.

1.3. A PACKAGE OF POLICIES WORKING TOGETHER

The greatest genius of California's approach; however, is the blending of a broad carbon price signal with well-crafted performance standards. This approach recognizes that there are many ways to cost-effectively decarbonize the economy beyond just putting a price on GHG emissions. Implementing performance standards means that the cap-and-trade program does not have to strain to change behaviors that are not sensitive to pricing instruments. The combination of policies in California has proven to be both carbon- and cost-effective.

Beyond the policies intended to encourage the market to embrace existing clean technology upgrades, California is also the front-runner in technological innovation. California not only deploys currently

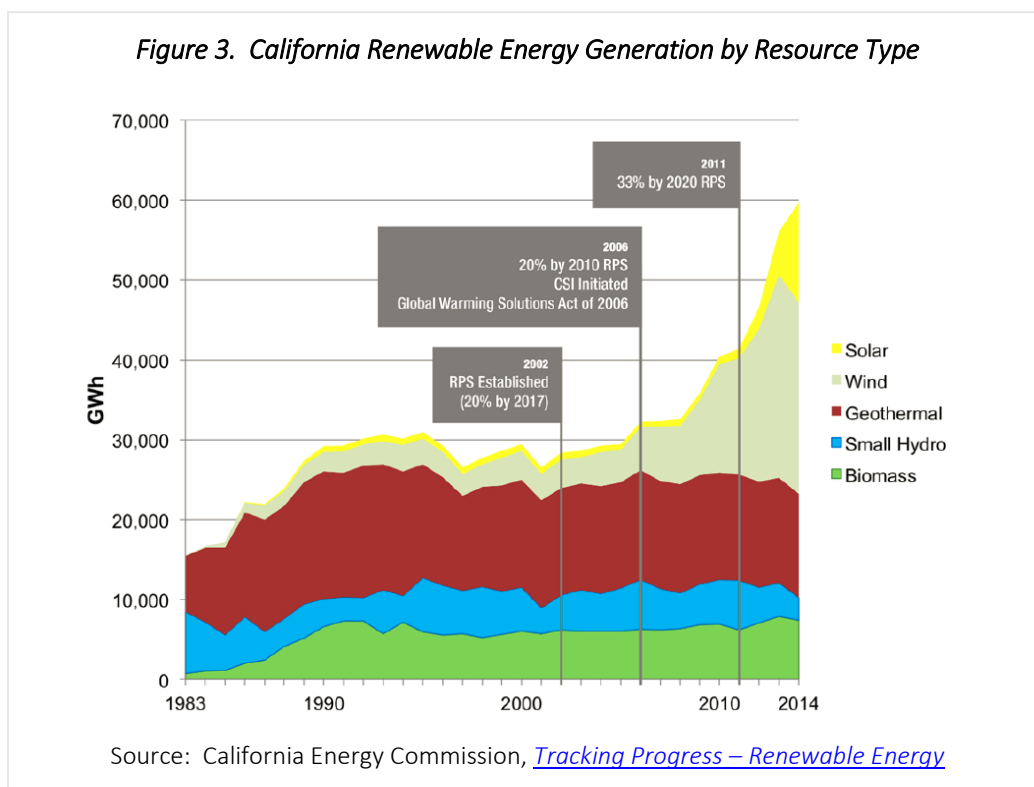
available clean technologies, but also invests heavily in Research and Development (R&D) and pilot programs to stoke the innovation pipeline. An example of these pilots is the electricity storage mandate, which calls for utilities to procure 1.3 GW of energy storage by 2020.

2. RESULTS SO FAR

California GHG emissions peaked in 2004, and have been declining since then, in terms of both per capita emissions and even more strongly in the carbon intensity of GDP. Since the adoption of AB 32 in 2006, emissions have fallen by [7 percent](#) (i.e. from 2007 to 2013, with 2013 being the most current available data). This section explores the results of California's efforts with regard to 1) clean energy, 2) economics, and 3) policy spillovers.

2.1. CLEAN ENERGY PROGRESS

One of California's most mature policy areas is renewable electricity. This is evident in Figure 3, which illustrates the state's increasing use of renewables. In 2002, California adopted a renewable portfolio standard (RPS) requiring large utilities to procure renewable electricity equal to 20 percent of sales by 2017. In 2006, the state advanced the target date for compliance to 2010. By 2014, the state's large investor-owned utilities had achieved 25 percent renewable electricity, not including power from large hydroelectric facilities or rooftop solar. Solar panels installed by homeowners and small businesses have not been eligible for utility compliance with the RPS, but Figure 3 includes both rooftop solar and utility-scale renewable energy.



California is also a leading adopter of plug-in electric vehicles (PEVs). Between March of 2011 and July 2015, consumers purchased more than [146,000 PEVs](#) in the state, roughly [half](#) of the U.S. total and 15

percent of global sales. The state has driven this progress through a combination of electric vehicle rebates, access to high occupancy vehicle lanes for PEVs, and a flexible Zero Emission Vehicle mandate where automobile manufacturers can trade compliance credits.

California is beginning to overcome its legacy of sprawling urban development, which has caused most people to rely on cars for transportation. Through smarter land use and greater emphasis on public transit and walkability, the state has [doubled](#) the share of trips by transit, walking, and biking over the last decade. San Francisco's strides in this regard are particularly notable. Among new residents of San Francisco since 2006, [51 percent are taking transit](#) to work, 18 percent are walking, and 14 percent are biking.

Figure 4. A new Transit-Oriented Development along Wilshire Avenue in Los Angeles.

The city of Los Angeles is rapidly [building up](#) a transit system. In 2008, Angelenos approved, [with a two-thirds supermajority](#) vote, a measure to increase the city's sales tax for this explicit purpose. The City is also promoting anything but car travel for the future of its transportation system in its [mobility plan](#). (Photo source: [iStock](#))



2.2. ECONOMIC BOOST

While economists continue to debate the macroeconomic effect of AB 32, it is clear that in recent years California's economy has been growing more vigorously than the U.S. as a whole. Since the recession ended, California jobs have grown by [14.4 percent, compared to 9.8 percent](#) for the nation. The San Francisco Bay Area attracts [50 percent](#) of national venture capital dollars. California's macro economy is performing well, and the state's energy and climate policies are working hand in glove with market forces to support the emergence of dynamic new companies that have put the state in a strong competitive position.

Drilling down on the microeconomics of clean energy and clean technology illuminates many bright spots. The state boasts about [500,000 green jobs](#), including more than 50,000 in the solar energy sector, and

there has been a steady growth over the past decade with clean energy jobs doing well through the recovery.¹ About 24 percent of California’s green jobs are in manufacturing, jobs that are generally recognized as better-paid work.

Tesla has taken the automotive industry by storm, and has revolutionized the electric car business. Battery costs are [coming down](#) rapidly as well, portending well for this industry. Today, Tesla has more than 6,000 employees in the state and is producing most of its vehicles in Fremont, California. The company is now making waves in the home electricity battery storage market. Tesla CEO Elon Musk is also a large shareholder of Solar City, which will pair its solar PV installations with Tesla’s new storage units so solar panel owners can have reliable, clean energy at all times of the day.

The electric bus maker Proterra recent relocated from South Carolina to California. Proterra CEO [Ryan Popple](#) notes how California’s energy policies and technology leadership influenced the company’s relocation: “It’s not an accident that the clean-vehicle industry is headquartered in California. California really invented the market, or forced the market, for hybrid technology and electric vehicles. It’s attracted the kinds of companies that want to work on these technologies.” One of Proterra’s electric buses recently travelled 258 miles on a single charge, an enormous feat for the industry.

2.3. POLICY SPILLOVERS

Policy spillovers, in which California policy spurs action in other places, are easiest to see in the case of the state’s longest standing policies: energy efficiency standards for buildings and appliances. In 1978, California became the first state to include energy requirements in its building code. Today, [43 states](#) (including Washington, D.C.) have followed suit. California’s appliance and lighting performance standards program also set the precedent, and inspired the current federal program. California created standards for 13 appliances or lighting components that were [later adopted](#) at the federal level.

California has long been a leader in clean vehicle policies and many of these have spread to other states or the federal level. In 2002, California broke new ground with Assembly Bill 1493, which required CARB to set tailpipe GHG performance standards. CARB’s regulatory work laid the foundation for the federal standards adopted during the first Obama administration.

While California can boast a long list of energy policy and clean tech innovations, it is important to note that many of the state’s policies have been borrowed from other jurisdictions. The state was not the first to develop a carbon cap-and-trade system, for example. The state has made some mistakes too, notably the faulty deregulation of the electricity sector in 2002. A lesson in this regard is the need to carefully consider how companies might game market mechanisms used to pursue climate goals.

3. LOOKING FORWARD: GOING DEEPER

Within the last year, the 2030 timeframe has emerged as a focus for California climate and energy policy. Ten years ago, former Governor Arnold Schwarzenegger signed an Executive Order to set a 2050

¹ The most authoritative and recent study was done by the Advanced Energy Economy, which found 430,000 jobs in 2014, with companies professing plans to add 70,000 jobs in the following year. This is how the figure of 500,000 is arrived.

emissions target of 80 percent below 1990 levels, but this long-term goal was too far into the future to motivate current-day policymaking. The 2030 perspective has produced a burst of activity.

In 2013, CARB released an [updated 2020 Scoping Plan](#). This document provides a useful summary of ongoing policymaking, but does not capture the new focus on establishing goals for 2030 and policies to achieve these. On October 15th, CARB launched a [2030 Scoping Plan](#) process that will help to coordinate the dozens of policy actions underway. A complete overview is beyond the scope of this document, but we will briefly touch on a few highlights. CARB has launched a process to set cap-and-trade design for the post-2020 period. CARB recently accelerated its low-carbon fuel standard, and the state is pushing for 1.5 million Zero Emissions Vehicles by 2025. With specific authority from the California legislature ([Senate Bill 605](#)), the state is attacking Short-Lived Climate Forcers, which are GHGs other than carbon dioxide, such as methane or high global warming potential gases, which act over shorter timeframes and are more potent than carbon dioxide. Reducing these pollutants offers great promise in tamping down peak emissions in the coming decades, and delivering strong health benefits as well. In typical form, CARB is developing a multi-sector, multi-policy instrument [approach](#) to solving the problem of Short-Lived Climate Forcers.

In September, the California Legislature passed SB 350, setting a 50 percent RPS by 2030, which the Governor signed in October. This law adds long-term certainty beyond the 33 percent RPS by 2020 requirement that was adopted in 2012. The decarbonization of the electricity system is well underway, but [the policy framework](#) needs to evolve to give stronger emphasis to system optimization. The RPS has been a great force for getting renewables built and helping to drive down their cost, but does not provide the incentives needed to optimize the rapidly transforming electricity system.

What allows for this vigorous policy action is Californians' confidence that economic prosperity and environmental quality are not just mutually compatible, but they are mutually required. Californians are convinced of the damages climate instability would impose, after the recent record-breaking drought and wildfires. The state has a long [coastline at risk](#) from sea level rise and intensified storms. This winter, the state faces an historic El Nino, which could portend large rains and floods to come.

More than fearful, the state mood is one of optimism. Californians are confident in not just the achievability of low-carbon prosperity, but also its advantageousness. There are benefits on multiple levels to the low-carbon transition: cleaner air, better public spaces, more green spaces, fewer car accidents, more efficient infrastructure, and better mobility married with better accessibility. Moreover, taking a leadership position on sustainability leads to a first-mover advantage for California in the technologies and businesses of the future.

As the world's nations gather in Paris in an effort to reach an agreement on how humanity will join together to manage GHG emissions, California is pleased to share the results of its leading edge work. California has created a vibrant economy running on cleaner energy. Innovative companies and better environmental quality (which supports productivity and attracts human talent) are working together in a virtuous cycle, making the state confident in deepening its climate policy efforts. The technology and design know-how needed to decarbonize our societies are cost-competitive, practical, and economically sound.