2014

CALIFORNIA GREEN INNOVATION INDEX

6TH EDITION

NEXT 10

NEXT 10'S *CALIFORNIA GREEN INNOVATION INDEX* TRACKS THE STATE'S PROGRESS IN REDUCING GHG EMISSIONS, GENERATING TECHNOLOGICAL AND BUSINESS INNOVATION, AND GROWING BUSINESSES AND JOBS THAT ENABLE THE TRANSITION TO A MORE RESOURCE-EFFICIENT ECONOMY. THE 2014 *INDEX* IS THE SIXTH EDITION PUBLISHED BY NEXT 10.

NEXT 10 IS AN INDEPENDENT NONPARTISAN ORGANIZATION THAT EDUCATES, ENGAGES AND EMPOWERS CALIFORNIANS TO IMPROVE THE STATE'S FUTURE.

NEXT 10 WAS FOUNDED IN 2003 BY BUSINESSMAN AND PHILANTHROPIST F. NOEL PERRY. NEXT 10 IS FOCUSED ON INNOVATION AND THE INTERSECTION BETWEEN THE ECONOMY, THE ENVIRONMENT, AND QUALITY OF LIFE ISSUES FOR ALL CALIFORNIANS.

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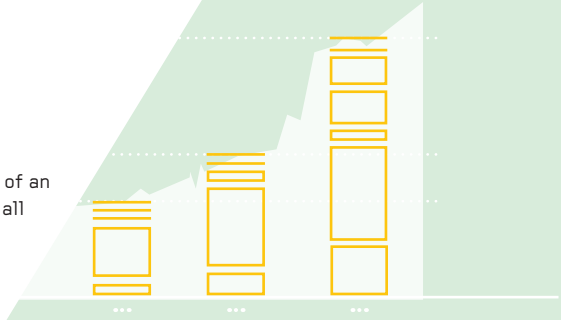
GROSS DOMESTIC PRODUCT (INFLATION ADJUSTED TO 2013 DOLLARS)

2012 **$2.0** TRILLION

1.7% AVERAGE ANNUAL GROWTH 1990 – 2012

2012 **$53,966** PER CAPITA GDP

Gross Domestic Product (GDP) is a way of measuring the size of an economy, and is calculated by summing the value added from all industries in the economy. This measure can be used for a country as well as a state.



CALIFORNIA'S CARBON ECONOMY

RATIO OF GHG EMISSIONS (METRIC TONS) TO GDP ($10,000)

1990 **3.14** 2012 **2.26**

INFLATION ADJUSTED TO 2013 DOLLARS

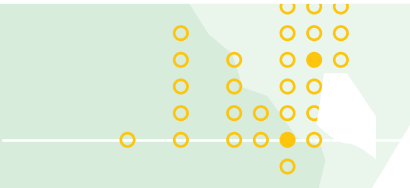
California's Greenhouse Gas Emissions – Gross greenhouse gas (GHG) emissions includes fossil fuel carbon dioxide (CO_2), with electric imports and international fuels (CO_2 only) and non-carbon GHG emissions (in CO_2 equivalents).

2013 **38** MILLION

1990–2013 **1.1%**

AVERAGE ANNUAL GROWTH RATE

POPULATION



TOTAL GHG EMISSIONS

1990 **431** 2011 **450.9** 2012 **458.7**

(MILLION METRIC TONS OF CO_2 EQUIVALENT)

1990–2012 **0.25%**

AVERAGE ANNUAL GROWTH

2011–2012 **1.7%**

ONE YEAR GROWTH

Assembly Bill 32 (AB 32) – The "California Global Warming Solutions Act of 2006." AB 32 has put California at the forefront of climate change policy by requiring the state to reduce its GHG emissions to 1990 levels by 2020.

PER CAPITA GHG EMISSIONS

2012 **12.2**

(METRIC TONS OF CO_2 EQUIVALENT)

AB 32 TARGET

TOTAL GHG EMISSIONS

2020 **431**

(MILLION METRIC TONS OF CO_2 EQUIVALENT)

EXECUTIVE ORDER TARGET

TOTAL GHG EMISSIONS

2050 **86**

(MILLION METRIC TONS OF CO_2 EQUIVALENT)

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Population Data Source: California Department of Finance.

Gross Domestic Product Data Source: Bureau of Economic Analysis. California Department of Finance.

Greenhouse Gas Emissions Data Source: California Air Resources Board, "California Greenhouse Gas Inventory – by Sector and Activity." California Department of Finance.

Carbon Economy Data Source: California Air Resources Board, "California Greenhouse Gas Inventory – by Sector and Activity." Bureau of Economic Analysis.

Dear Californians,

It is my pleasure to release Next 10's sixth edition of the *California Green Innovation Index*. Since we launched the inaugural *Index* in 2008, we have witnessed and documented the shift to a cleaner, more efficient economy as the impacts of climate change have become increasingly apparent. **California's leadership in adopting and implementing innovative policies** continues to spur research and investment in new technologies, encouraging market demand for products and services that grow the economy, while reducing greenhouse gas emissions.

Our Policy Timeline documents over 65 years of innovative policies adopted by California, including the 1947 creation of the state's first Air Pollution Control District and the recent landmark mandate by the California Public Utilities Commission that utilities adopt a combined 1,325 MW of energy storage by the year 2020. The energy storage sector illustrates how policy can advance innovation and growth, and the *Index* includes a special feature dedicated to this sector, examining trends in jobs, investments, patents and policies.

Data gathered in this year's *Index* show that **California's forward-looking policies have helped create a foundation for innovation and removed early barriers to consumer demand.** The *Index* finds that as these market barriers come down, consumers respond with increased demand for clean technology products and services, thus sustaining a long-term market growth cycle. This increasing consumer demand is particularly noticeable in the rapid installation of solar, as well as the growing purchase of zero emission and alternative fuel vehicles.

The 2014 *California Green Innovation Index* documents that progress is being made to transition to cleaner, more efficient energy sources while increasing economic growth. As consumer demand, private investment, and innovative policies such as cap-and-trade and the recent program linkages with Quebec, other western states, and even China continue to drive clean energy market growth, California continues to lead the way in making the transition to a low carbon economy.

Looking forward, previous Next 10 research has concluded that a 2030 target for emissions reductions would create the additional policy certainty needed to drive vital investments and research and development efforts. California's leadership and progress can serve as model for other states, the nation, and the world.

Sincerely,

F. Noel Perry

F. Noel Perry

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CALIFORNIA'S PAST AND FUTURE

CALIFORNIA'S POLICIES LAY THE FOUNDATION FOR CLEAN ECONOMY MARKET GROWTH

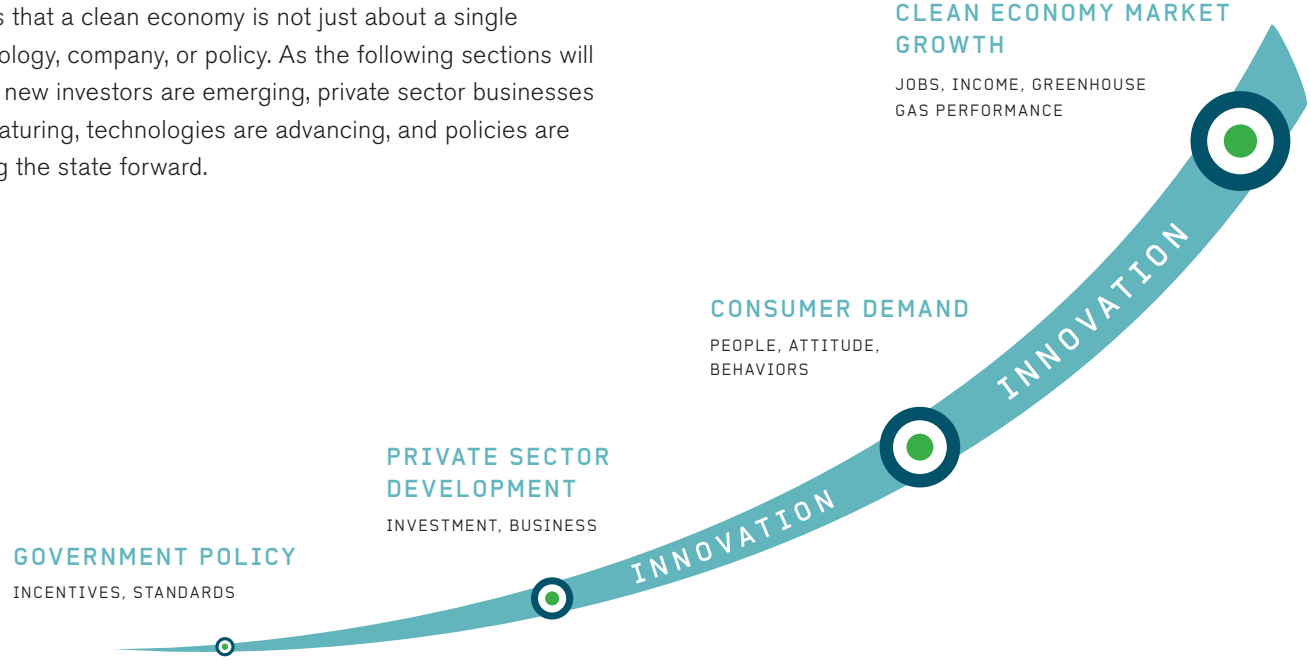
California is known for its entrepreneurial spirit and for pushing the envelope with innovative activities. The clean technology sector is no exception, with California leading the way in technology and policy breakthroughs in sustainability and energy across a range of industries. By growing its clean technology economy, California demonstrates that economic prosperity and environmental protection are not mutually exclusive concepts.

The *California Green Innovation Index* provides data that show California's policies have helped create a foundation for innovation and removed early barriers to consumer demand. As good policy stimulates both innovation and investment to create new clean technology products and services, consumers are then able to respond with increased demand, thus sustaining a long-term virtuous market growth cycle. Innovation is a key component to growing the sector, and is an iterative process that occurs throughout market development. When consumer demand rises, investors and businesses perceive more opportunity in the market, which prompts development of technology, lowers prices and subsequently increases consumer demand. Building on California's past success, the state's next increment of smart policy can accelerate this market cycle dramatically.

The progress made in California's clean technology market shows that a clean economy is not just about a single technology, company, or policy. As the following sections will show, new investors are emerging, private sector businesses are maturing, technologies are advancing, and policies are driving the state forward.

CALIFORNIA'S INNOVATIVE POLICIES SPAN DECADES

California is a national and global leader in innovative environmental and energy policy, building off its decades of experience. The state's policies and programs have been replicated in other states and used as a model for federal legislation. Recognizing that the state cannot solve climate change alone, California recently made strides to encourage other entities into action by setting an example and creating new partnerships with state and international entities on greenhouse gas and transportation issues. We document examples of policy innovations spanning back to 1947 in a pullout timeline in the middle of this report, including recent policies such as the California Public Utilities Commission energy storage mandate, new and renewed laws to reduce emissions from automobiles and encourage zero emission vehicle adoption, and a voluntary green tariff to enable customers to purchase renewable electricity. These policies are the product of combined efforts by public leaders, business leaders, grassroots organizations, and voters.



DASHBOARD INDICATORS

The dashboard indicators track the state's progress in the carbon economy, energy efficiency, renewable energy, clean technology innovation, and transportation, as well as the employment created by companies developing, installing and supporting clean technology. Tracking progress in multiple aspects of California's clean technology sector demonstrates how the state is maintaining its pacesetter position and reveals emerging areas of clean technology innovation.

California's clean economy is diversifying and continuing to generate economic benefits while protecting air quality and natural resources. California ranks among the most efficient and least carbon intensive economies in the world, and has achieved improvements in energy efficiency while growing the economy and lowering energy bills for consumers. Renewable energy installations and generation in the state continue to surpass previous year records. California also leads in clean technology innovation, with its companies receiving the most investment and patents in the nation, and more than many countries. This innovation, along with forward-looking policies, drives the state's progress in developing and implementing clean technology products and services. These diverse activities are also leading to a growing number of jobs across California.

THE CARBON ECONOMY

California is a leader among states and countries in reducing carbon emissions while boosting the economy. California's cap-and-trade program launched in 2012 and completed a successful first year (see box below),[1] and in 2013 the California Air Resources Board released a draft update to its Scoping Plan that lays out strategies and recommendations for emissions reductions in the next five years. California is also driving international action on climate change by working directly with other entities to align policies and programs. On Jan. 1, 2014, California linked its cap-and-trade program with Quebec. The state also announced a historic pact to align greenhouse gas reduction policies with Oregon, Washington, and British Columbia; and executed a series of international agreements to partner with China, Mexico, Peru, and other countries on carbon reduction policies and technologies.

California ranks among the most efficient and least carbon intensive economies in the world (Figure 1). California's emissions per dollar of gross domestic product (GDP) dropped by 30 percent between 1997 and 2011, meaning that for the same amount of economic activity, the economy released significantly fewer emissions. This change represented one of the largest improvements in carbon intensity in the nation.

WHY IS IT IMPORTANT?

While California was an early leader in innovative carbon reduction policies, the state's economy, as well as the national and international economies, is still dependent on carbon-based energy. In order to meet the state's goals for reducing emissions, it is necessary to find cleaner ways to create and transport our products. Indicators relating to the carbon economy help track this shift and illustrate the changing relationship between economic vitality and environmental quality.

CALIFORNIA'S CAP-AND-TRADE PROGRAM SHOWS A STRONG MARKET

California's cap-and-trade program, authorized under AB 32, launched in November 2012 and to date the state has successfully held six quarterly auctions of greenhouse gas emission allowances. In each auction, all current allowances were sold and there was active participation by businesses in a variety of sectors, indicating a strong demand even while the state was recovering from the recent economic downturn. In the latest auction in February 2014, 71 qualified bidders participated and over 19.5 million current allowances were sold at $11.48 per allowance, 14 cents above this year's floor price.

These auctions will steadily reduce emissions while generating proceeds. The state will reinvest auction revenues in carbon reduction and environmental projects across California in coming years. In fiscal year 2014-2015, Governor Jerry Brown proposed spending $850 million to reduce emissions through investments in low carbon transportation, sustainable communities, energy efficiency, and natural resource management. California consumers are also starting to see direct benefits in the form of a semi-annual "climate credit" on their utility bill starting in April 2014.

California's carbon efficiency also improved, with per capita emissions dropping 14 percent over the same time period. By comparison, Texas continued to have the highest level of total emissions in the nation, but improved since 1997 with a 40 percent decrease in carbon intensity and 29 percent drop in per capita emissions. California played an important role in decreasing carbon intensity in the nation overall; without the benefit of California's decrease, the U.S. without California actually increased carbon intensity by five percent between 1997 and 2011. In 2011, advanced economies including the United States, Germany, and France continued to trend towards a carbon free economy. At the same time, per-capita emissions rose in carbon-intensive developing economies such as China and India and also rose slightly in Japan.

Emissions per capita in California rose one percent in 2012 compared to 2011 as overall emissions increased slightly more than population, reaching 12.2 metric tons of carbon dioxide equivalent ($MTCO_2e$) per person in 2012. Over the longer term, emissions per capita have dropped 17 percent since 1990 (Figure 2). This long-term efficiency improvement was achieved while growing the economy, illustrated by a 16 percent rise in GDP per person since 1990 and 2.2 percent jump since 2011.

California continues to move towards a carbon free economy through a steady decrease in carbon intensity (emissions per GDP) (Figure 3). California emitted 2.26 $MTCO_2e$ per $10,000 of GDP generated in 2012, a 28 percent drop from 1990 and a 1.1 percent decrease since 2011.

TABLE 1. NATIONAL CARBON ECONOMY RANKING

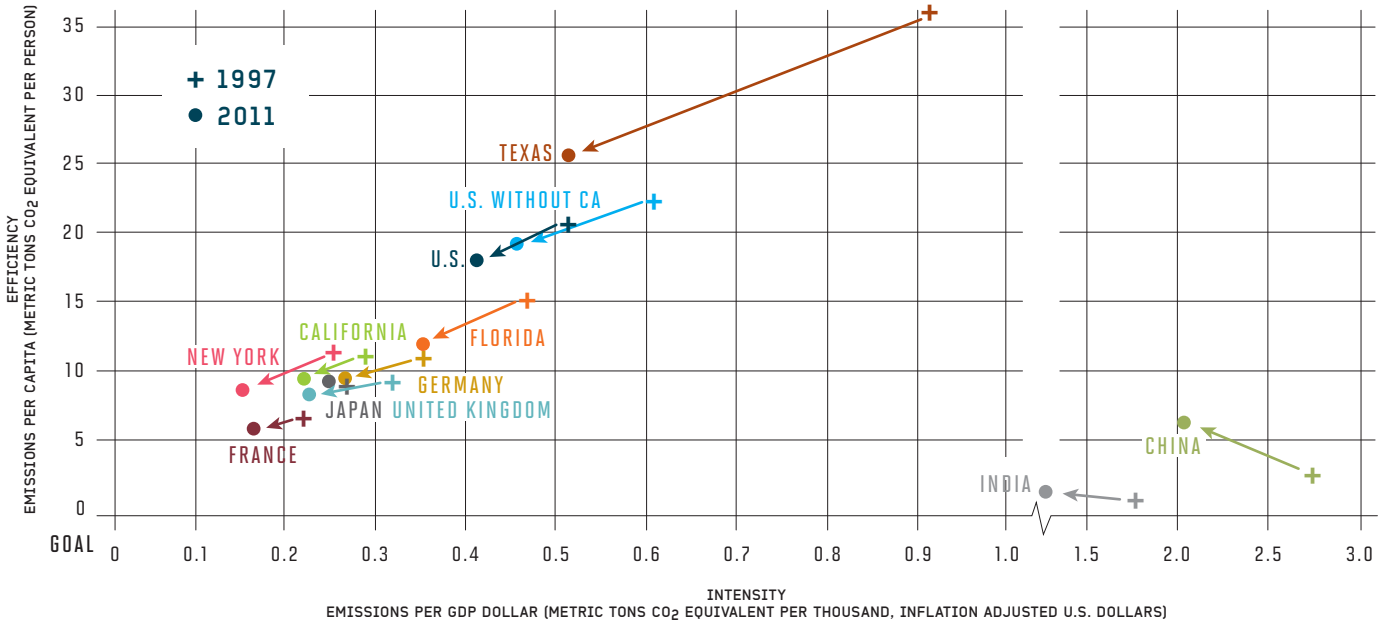
2011 LOWEST CARBON INTENSITY (EMISSIONS/GDP)

NEW YORK	1
CONNECTICUT	2
MASSACHUSETTS	3
CALIFORNIA	4
DELAWARE	5
FLORIDA	19
U.S. WITHOUT CALIFORNIA	27
TEXAS	33
WYOMING	50

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: Energy Information Administration, U.S. Department of Energy; Bureau of Economic Analysis, U.S. Department of Commerce. Analysis: Collaborative Economics

FIGURE 1. GLOBAL FOSSIL FUEL COMBUSTION IN CALIFORNIA AND OTHER REGIONS

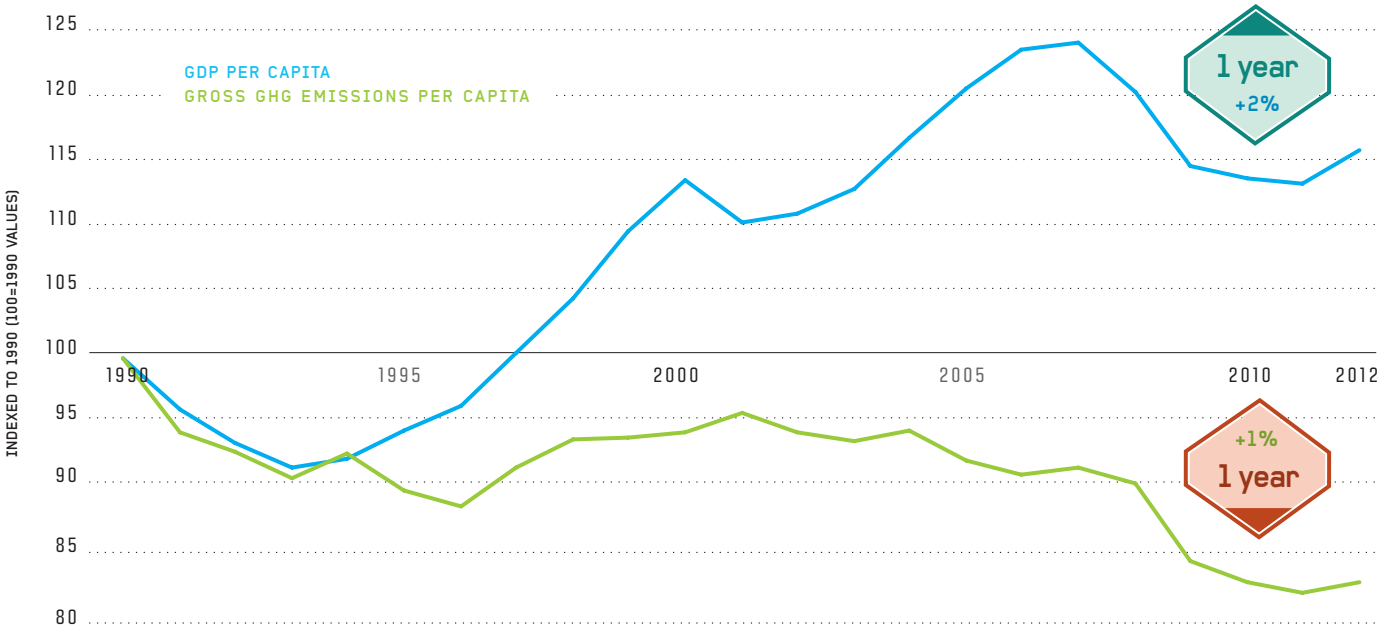
CARBON INTENSITY AND EFFICIENCY 1997 TO 2011



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: U.S. Department of Energy, Energy Information Administration, International Energy Statistics and State CO2 Emissions; Bureau of Economic Analysis, U.S. Department of Commerce; U.S. Census Bureau, Population Estimates Branch; The California Department of Finance. Analysis: Collaborative Economics

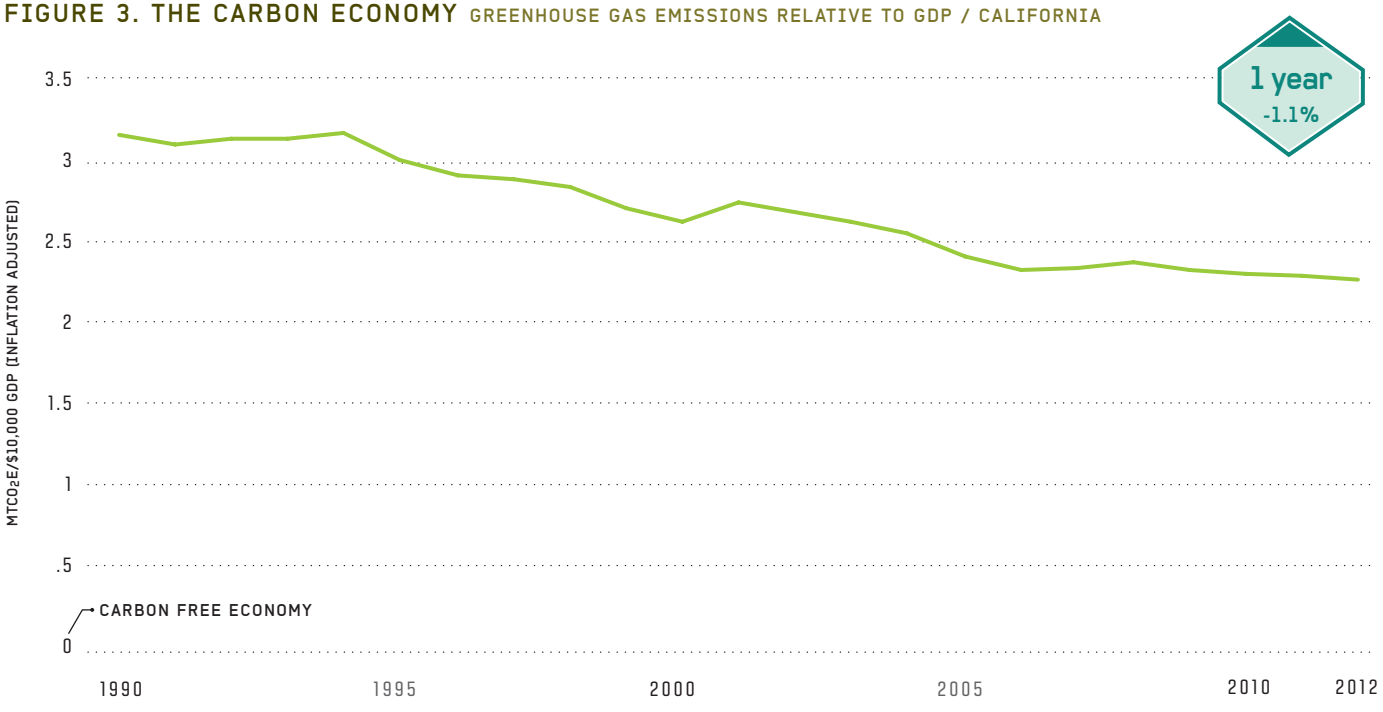
FIGURE 2. GREENHOUSE GAS EMISSIONS AND GROSS DOMESTIC PRODUCT

CALIFORNIA RELATIVE TRENDS SINCE 1990 / GREENHOUSE GAS EMISSIONS ($MTCO_2E$) AND GDP DOLLARS, PER CAPITA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory - by Sector and Activity; Bureau of Economic Analysis, U.S. Department of Commerce; California Department of Finance. Analysis: Collaborative Economics

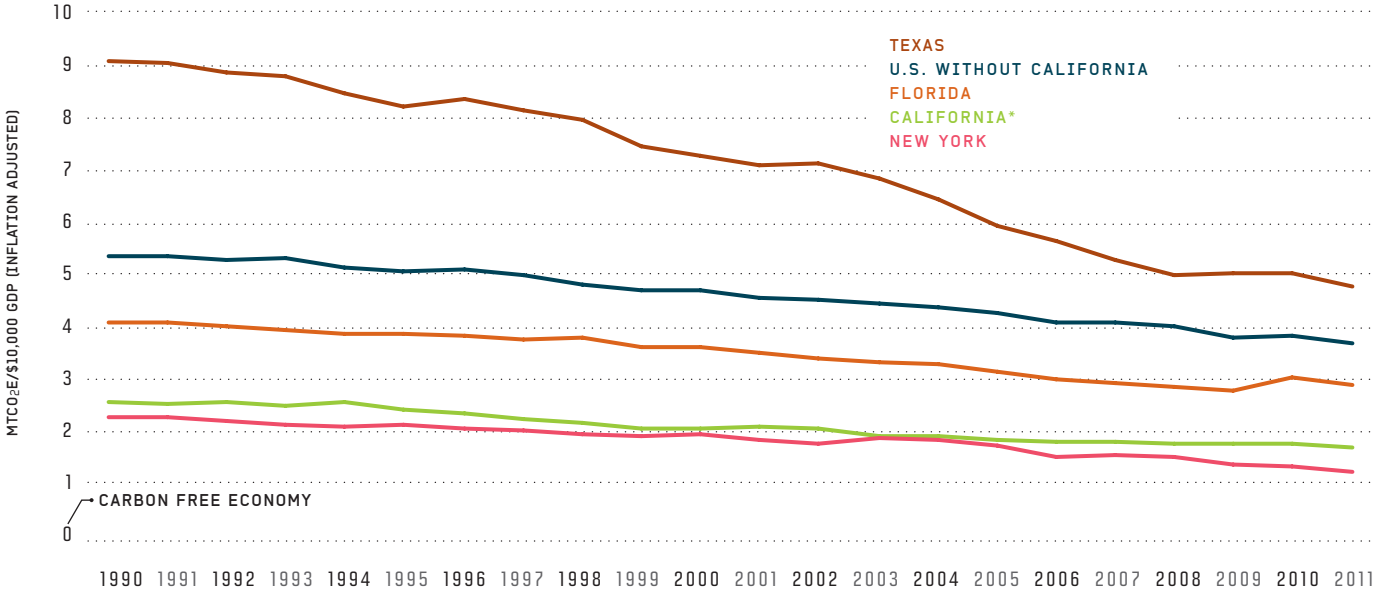
FIGURE 3. THE CARBON ECONOMY GREENHOUSE GAS EMISSIONS RELATIVE TO GDP / CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory - by Sector and Activity; Bureau of Economic Analysis, U.S. Department of Commerce; California Department of Finance. Analysis: Collaborative Economics

FIGURE 4. THE CARBON ECONOMY IN CALIFORNIA & OTHER STATES

GREENHOUSE GAS EMISSIONS ($MTCO_2E$) PER 10,000 DOLLARS GDP (INFLATION ADJUSTED)



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. *GHG emissions data that allows for state-level comparison is from the Energy Information Administration and is limited to carbon emissions (fossil fuel combustion). Therefore, data represented here differs from analyses represented in other charts of total GHG emissions for California. Data Source: Energy Information Administration, U.S. Department of Energy; Bureau of Economic Analysis, U.S. Department of Commerce. Analysis: Collaborative Economics

California continues to be a leader in emissions reduction in the United States. In 2011, California moved up one spot to become the fourth least carbon dependent economy (measured as emissions per GDP) in the U.S., following New York, Connecticut, and Massachusetts (Table 1). California's economy was less carbon dependent than the national average, as well as other large states, as illustrated in Figure 4. California generated less than half the amount of emissions per GDP than Texas, and improved four percent from 2010 to 2011. The other states shown experienced similar declines, and Texas achieved the biggest decrease (-7%) in the recent year. Since 1990, California's carbon intensity declined 33 percent, an improvement over the U.S. average and Florida, though less than Texas and New York with 47 percent and 44 percent declines, respectively.

Total greenhouse gas emissions in California rose slightly in 2012 compared to 2011, up 1.7 percent to 458.7 million $MTCO_2e$ (Figure 5). This rise is primarily attributed to the shutdown of the San Onofre Nuclear Generating Station and a relatively dry year that decreased hydro power, both of which are emissions-free energy sources for the state.[2]

In comparison, the nation overall decreased emissions by 3.3 percent in 2012 from 2011, primarily due to using less carbon intensive fuels (e.g. natural gas) and a relatively warm winter in 2012 that decreased heating demand.[3] Despite the state's recent uptick, California's multi-faceted emissions policies are expected to keep the state on track to meet its target of reaching 1990 emissions levels by 2020.

The transportation sector was the source of the largest portion (37%) of California's greenhouse gas emissions, followed by the industrial and electric power sectors (Figure 6). The California Air Resources Board collects greenhouse gas emissions data by direct source of emissions rather than by end-user. Figure 7 shows the state's emissions by detailed direct source.

Transportation 37%: Emissions from all transportation sources accounted for 37 percent of California's total emissions, down from 38 percent of the total in 2011. More than two-thirds (69%) of transportation emissions came from passenger vehicles and 21 percent from heavy-duty trucks. Other sources, including ships and boats,

locomotives, off-road vehicles, and domestic (intrastate) aviation, accounted for the remaining ten percent of total transportation emissions.

Industrial 22%: Industrial activities contributed roughly 22 percent of California's emissions in 2012, down 0.2 percent of the total from 2011. About one-third (30%) of these emissions came from petroleum refining, with industrial manufacturing (18%) and oil & gas extraction (17%) representing the next largest sources. Other emissions from industrial sources included cogeneration, landfills, cement plants, and wastewater and solid waste treatment.

Electric Power 21%: Greenhouse gas emissions related to electricity generation contributed 21 percent to California's total emissions in 2012, up from 20 percent of the total in 2011. Of these emissions, in-state electric power generation (including natural gas and other fuels) accounted for 54 percent, while 46 percent derived from electric power imports.

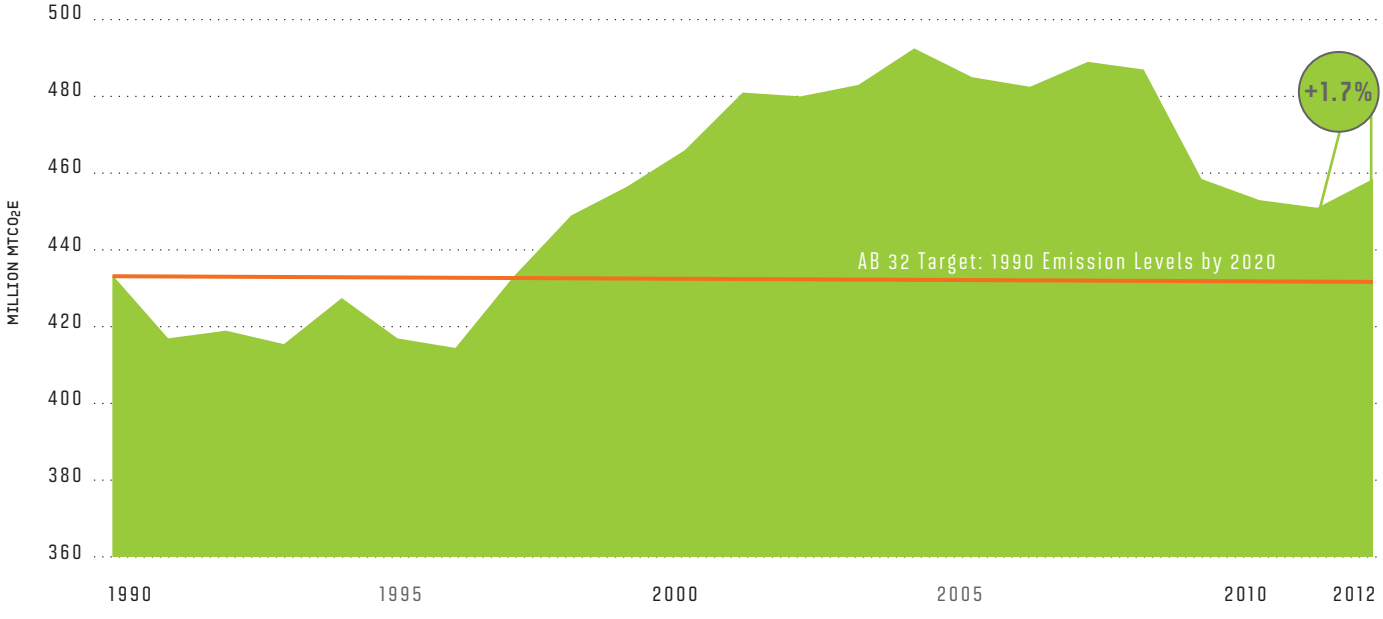
Agriculture and Forestry 8%: Emissions from agriculture & forestry represented eight percent of California's total emissions in 2012, up a slight 0.2 percent of the total from 2011. Livestock emitted nearly two-thirds (63%) of total agriculture and forestry emissions. Crop growth and harvesting accounted for 28 percent of emissions, while the remainder (9%) came from other sources such as soil cultivation and agricultural residue burning.

Residential 7%: The residential sector comprised seven percent of total emissions in the state in 2012, down 0.4 percent of the total from 2011. Residential sector emissions are largely from combustion of natural gas and other fuels to heat houses and buildings, prepare food, and heat water.

Commercial 5%: Emissions from commercial fuel combustion and cogeneration heat output accounted for five percent of emissions statewide in 2012, with no relative total change from 2011. The vast majority of these emissions were from combustion of natural gas and other fuels for uses such as heating buildings.

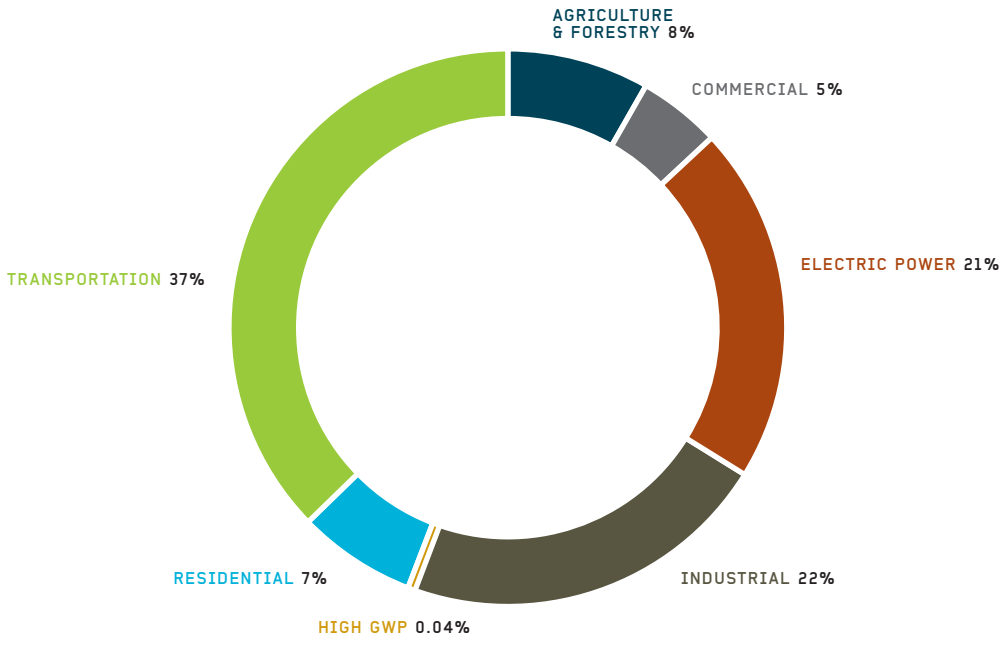
High Global Warming Potentials (GWP) 0.04%: High GWP not incorporated into other categories, as well as unclassified fugitive greenhouse gas emissions, made up less than one percent of California's total in 2012, the same as 2011. These emissions came largely from evaporative losses of chemicals and solvents.

FIGURE 5. TOTAL CALIFORNIA GREENHOUSE GAS EMISSIONS GROSS ANNUAL EMISSIONS



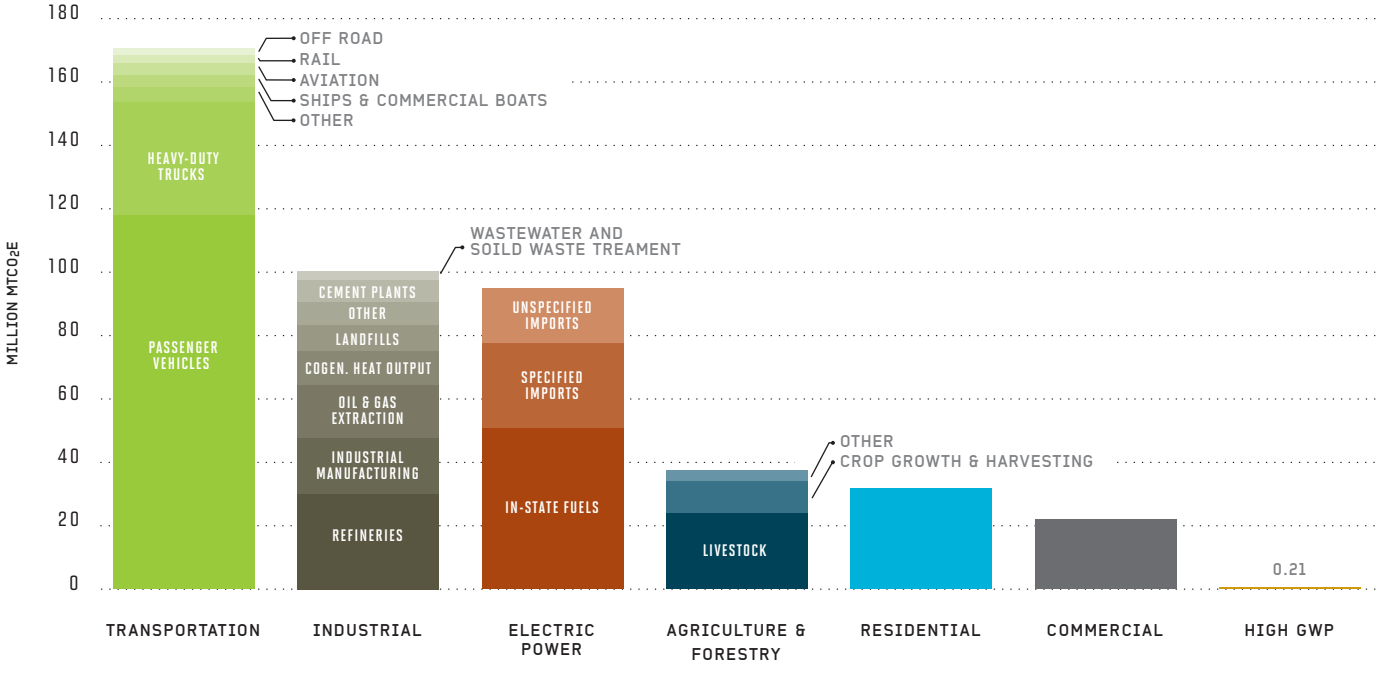
NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Gross greenhouse gas emissions (GHG) includes fossil fuel CO_2, with electric imports and international fuels (carbon dioxide equivalents) and noncarbon GHG emissions (in CO_2 equivalents). Noncarbon GHG emissions are made up of Agriculture (CH_4 and N_2O), Soils, ODS substitutes, Semi-conductor manufacture (PFCs), Electric Utilities (SF6). Cement, Other Industrial Processes, Solid Waste Management, Landfill Gas, and Wastewater, Methane from oil and gas systems, Methane and N_2O from Fossil Fuel Combustion. Data Source: California Air Resources Board, California Greenhouse Gas Inventory - by Sector and Activity. Analysis: Collaborative Economics

FIGURE 6. GREENHOUSE GAS EMISSIONS BY SOURCE CALIFORNIA 2012



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory - by Sector and Activity. Analysis: Collaborative Economics

FIGURE 7. GREENHOUSE GAS EMISSIONS BY DETAILED SOURCE CALIFORNIA 2012



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory - by Sector and Activity. Analysis: Collaborative Economics

ENERGY EFFICIENCY

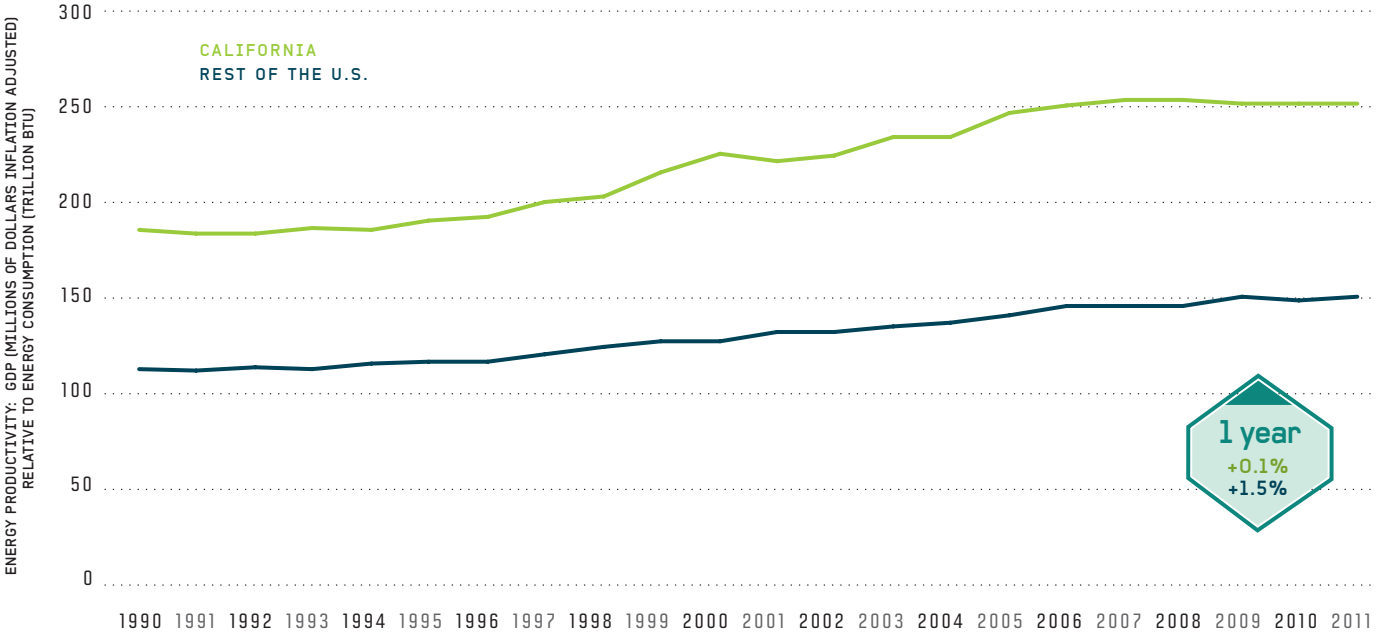
California has been at the forefront of energy efficiency policy and business activity since the 1970s. The American Council for an Energy-Efficient Economy continues to rank California as one of the top states in the nation for its energy efficiency progress, surpassed only by Massachusetts in 2013.[4] California pioneered policies that promote energy efficiency, such as utility revenue decoupling, and continues to have the nation's leading building energy codes and appliance standards.[5] In 2013, the California Public Utilities Commission boosted its commitment to energy efficiency by adopting an incentive mechanism called the Efficiency Savings and Performance Incentive. This incentive rewards investor-owned utilities for helping customers achieve long-term energy savings.[6]

Over the last 20 years, California's GDP increased at a much faster rate than its energy use, leading to improved

WHY IS IT IMPORTANT?

Energy efficiency enables consumers to optimize their energy use and consume less energy for the same level of service. Energy efficiency is an important way to reduce greenhouse gases and the water use from electricity generation, while creating jobs and saving consumers money. Indicators that measure California's change in electricity and overall energy consumption, while factoring in changes in population and the economy, can show how the state is progressing towards making energy more affordable and efficient.

FIGURE 8. ENERGY PRODUCTIVITY GDP RELATIVE TO TOTAL ENERGY CONSUMPTION / CALIFORNIA & REST OF THE U.S.



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: U.S. Energy Information Administration, State Energy Data System; U.S. Department of Commerce, Bureau of Economic Analysis. Analysis: Collaborative Economics

energy productivity. Energy productivity measures the GDP produced (economic output) for each unit of energy consumed (resource input). In 2011, California generated $2.52 of GDP for every 10,000 British Thermal Units (BTU) of energy consumed, while the rest of the U.S. generated $1.51 (Figure 8). In other words, California created 1.7 times as much economic activity as the rest of the U.S. with the same amount of energy. Energy productivity in the rest of the U.S. improved more than California between 2010 and 2011 (+1.5% and +0.1% respectively). However, in the longer term, California increased slightly more, with a 36 percent rise since 1990, while the rest of the U.S. increased 34 percent.

California's energy efficiency has outpaced the rest of the U.S. over time. Per capita energy consumption in the state decreased since the late 1970s when major energy efficiency policies were introduced, down 24 percent in California in 2011 compared to 1970 (Figure 9). In contrast, energy consumption per person in the rest of the U.S. declined by only four percent over the same period. Total energy consumption in California and the U.S. was higher in 2011 than 1970.

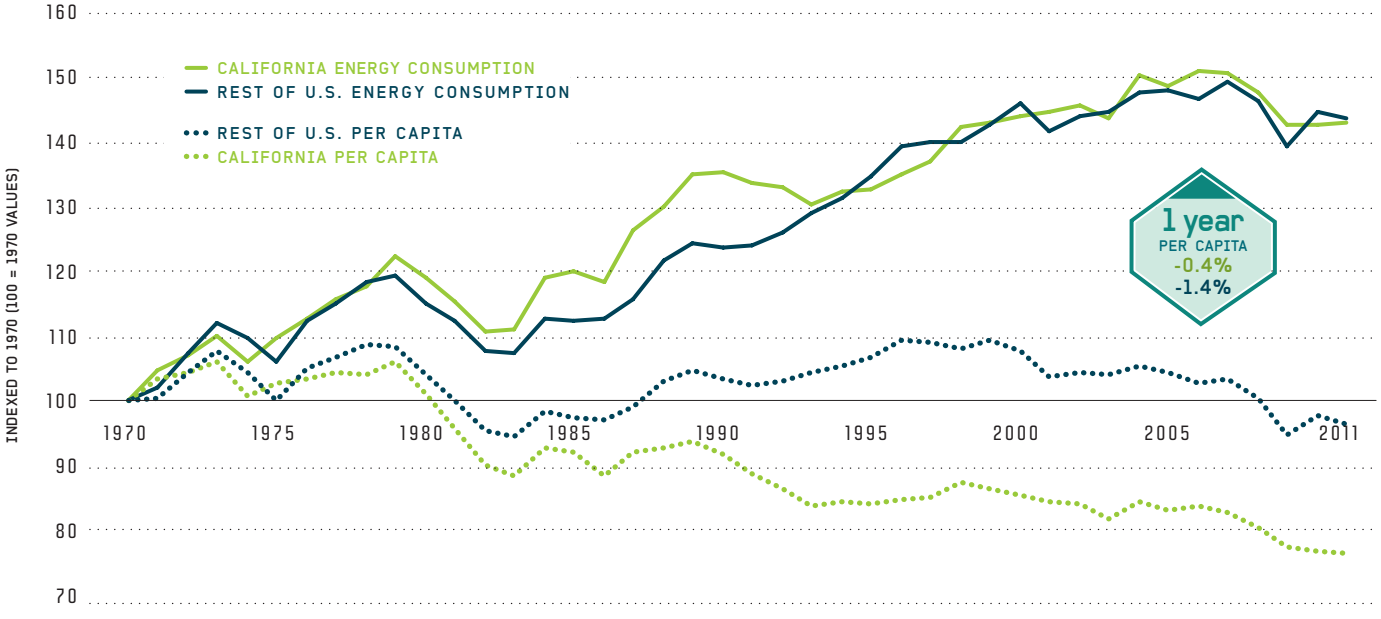
TOTAL ENERGY CONSUMPTION, 2011

	ENERGY CONSUMPTION IN BILLIONS OF BTUS	PER CAPITA CONSUMPTION
CALIFORNIA	7,858,376	0.21
REST OF U.S.	89,528,938	0.33

California generated energy from a variety of sources in 2011, and used it across five main sectors (Figure 10). Compared to the U.S. as a whole, California is less dependent on carbon intensive energy; the U.S. got 20 percent of its energy from coal and nine percent from renewable energy, compared to one percent from coal and 12 percent from renewables in California. Half of California's energy came from petroleum, most (84%) of which was used in the transportation sector. Natural gas was the next largest energy source, and was split primarily among the Industrial (35%), Electric Power (29%) and Residential (24%) sectors. Renewable energy accounted for 12 percent of California's energy consumption and was primarily used by the Electric Power sector, though nine percent was directly used in the Residential sector. The Transportation sector was the largest consumer of energy in California in 2011 with 43 percent of total primary energy consumption. The Electric

FIGURE 9. TOTAL ENERGY CONSUMPTION RELATIVE TO 1970

TOTAL CONSUMPTION & PER CAPITA / CALIFORNIA & REST OF THE U.S.



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: U.S. Energy Information Administration, State Energy Data System; U.S. Census Bureau, Population Estimates Branch. Analysis: Collaborative Economics

Power sector was the second largest, with 25 percent of total consumption, nearly half (40%) of which comes from renewable energy. The third largest sector was Industrial (18%), with over half of its energy from natural gas.

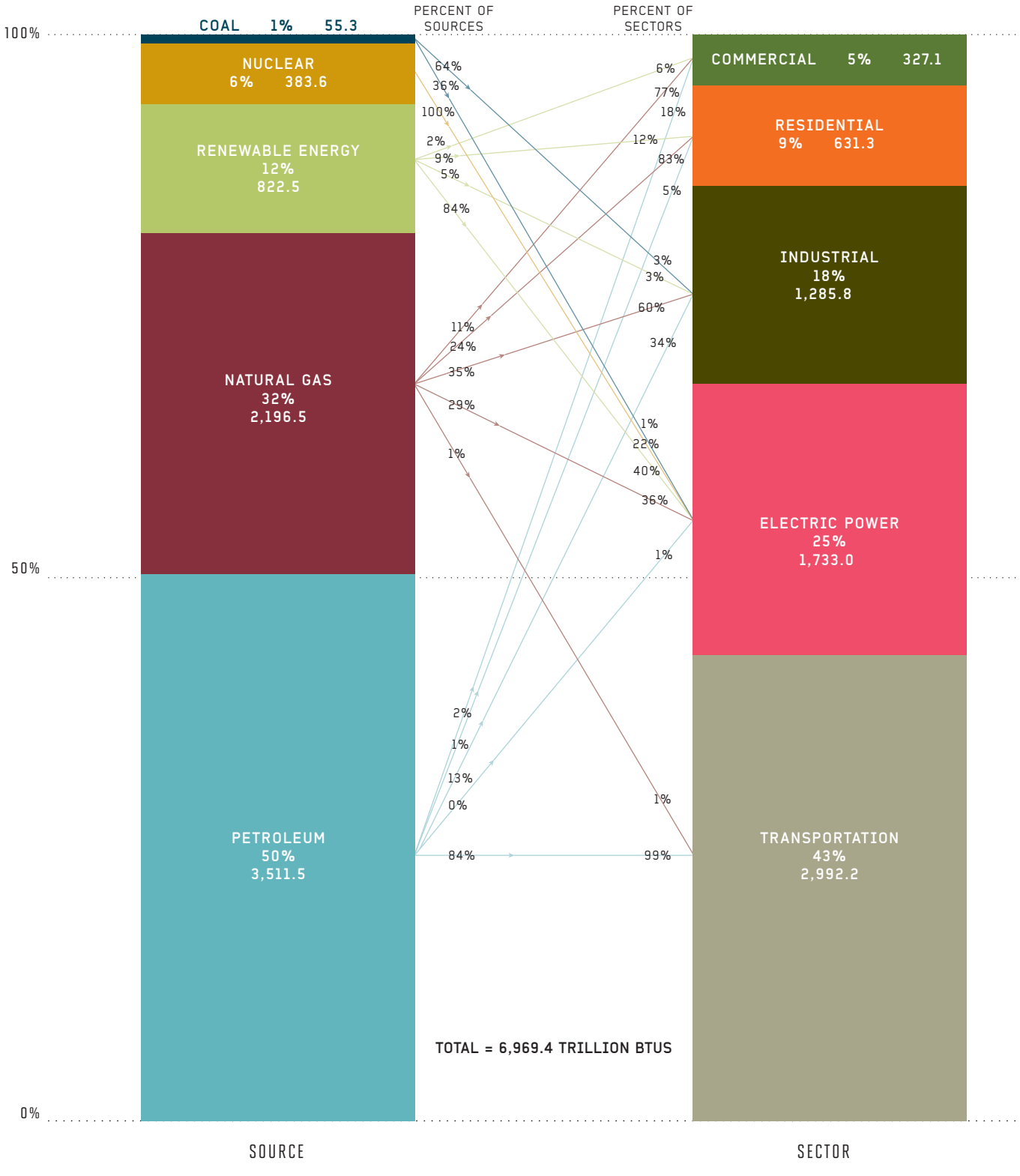
California's electric utilities outperformed the rest of the nation in efficiency. In 2012, California used four percent less electricity per capita than it did in 1990, while total electricity consumption increased 18.4 percent (Figure 11). In contrast, the rest of the U.S. became less efficient over the same period, with an 8.3 percent increase in per capita consumption and 27 percent jump in total consumption. California became even more efficient in the most recent year, with a nearly two percent drop in per capita consumption and 1.2 percent decrease in total electricity consumption between 2011 and 2012. The rest of the U.S. had a similar recent improvement, with a 2.5 percent drop in per capita consumption and 1.7 percent decline in total consumption.

Electricity in California was used by a variety of sectors in 2012, with the Commercial sector consuming more than a third of the electricity (Figure 12). The Residential sector was the next largest (32%) followed by the Industrial sector (14%). The mix of California electricity consumption by sector remained fairly stable over the ten years prior to 2012. The Industrial sector experienced the most notable shift, reducing its electricity consumption by nearly twenty percent, down from 19 percent of the total in 2000 down to 14 percent in 2012. Electricity use in these sectors is also tied to water use for treatment, transportation, and end-use. As California experiences water shortages during the current drought, understanding the water-energy relationship and improving water efficiency will be increasingly important.

California's energy policies helped improve efficiency and reduce greenhouse gas emissions across the state without increasing electricity bills. Another way to demonstrate a state's energy productivity is by evaluating the total amount spent on electricity compared to the state's total economic output. Money not spent on energy costs, whether by a household, business or public entity, can be invested in capital upgrades that boost productivity or can be invested in the creation of new jobs.

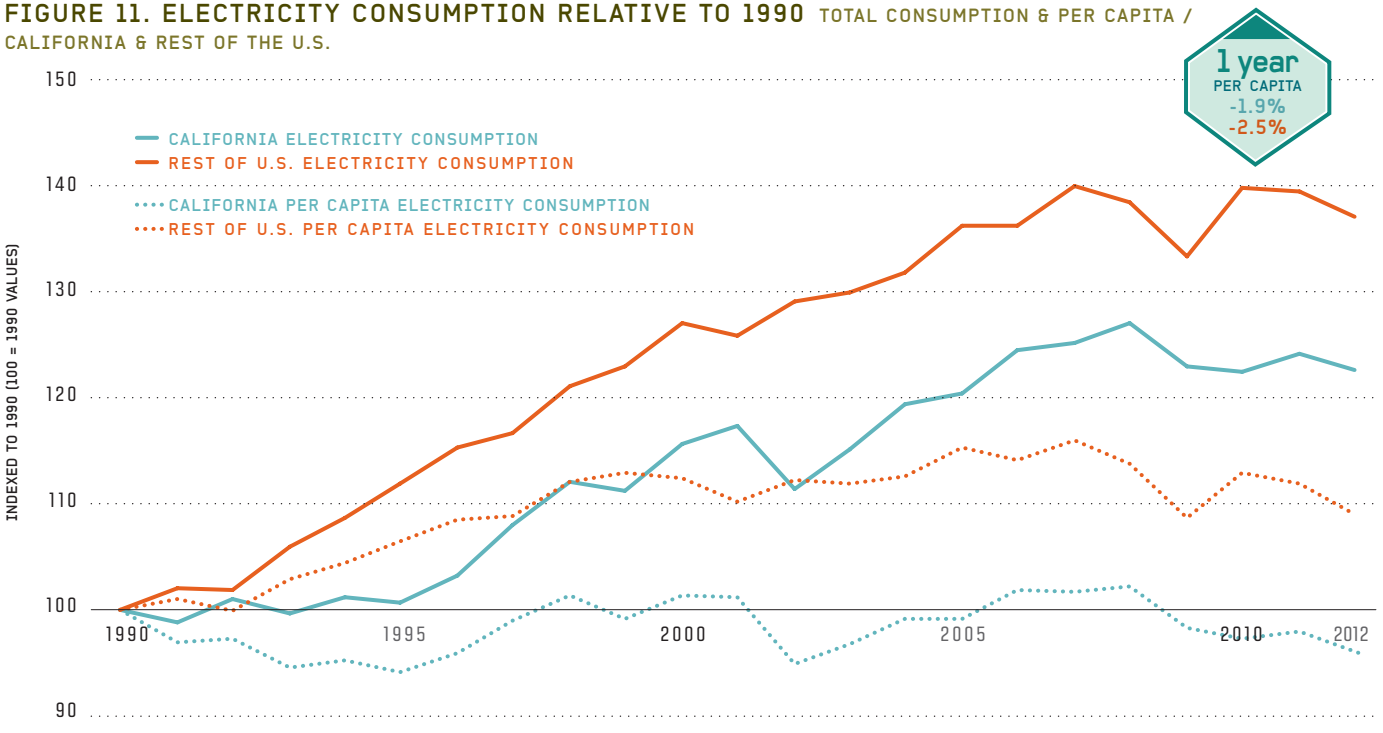
California's statewide electricity bill as a share of its GDP was significantly lower than many states with comparable economies, populations and geographic areas in 2012 (Figure 13), equating to only 1.78 percent of the state's GDP in 2012. While California's statewide electricity bill share of GDP remained relatively constant in recent years, California improved over the long term. In comparison with other large states, the statewide electricity bill in Texas was 2.25 percent of GDP, Florida's bill equated to 2.96 percent of GDP, and New York's recent decline brought it on par with California's level of 1.8 percent of GDP in 2012. Texas saw the largest decline of the four states since 1990, (1.4 percentage points), which could be attributable to its doubling of GDP over the same time. California's electricity bill share of GDP was 0.47 percentage points less than Texas in 2012. In terms of California's GDP, this equates to about $9.5 billion that Californians did not spend on electricity than if it had the same efficiency as Texas.[7]

FIGURE 10. PRIMARY ENERGY CONSUMPTION BY SOURCE AND SECTOR CALIFORNIA 2011, TRILLION BTU



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: The Commercial, Residential, and Industrial sectors do not include electricity used; that energy is captured in the Electric Power sector.
Data Source: U.S. Energy Information Administration, State Energy Data System. Analysis: Collaborative Economics

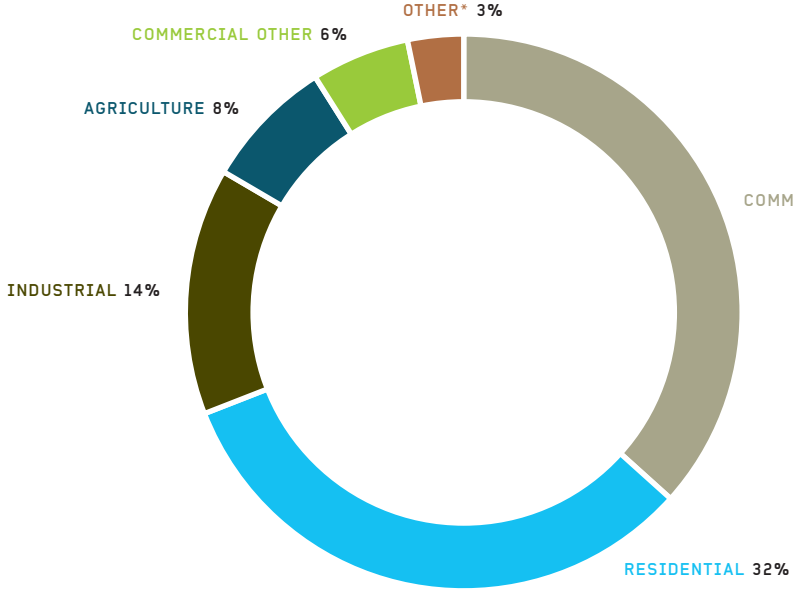
FIGURE 11. ELECTRICITY CONSUMPTION RELATIVE TO 1990 TOTAL CONSUMPTION & PER CAPITA / CALIFORNIA & REST OF THE U.S.



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: U.S. Department of Energy, Energy Information Administration; U.S. Census Bureau. Analysis: Collaborative Economics

FIGURE 12. ELECTRICITY CONSUMPTION BY SECTOR CALIFORNIA

PERCENT OF TOTAL ELECTRICITY CONSUMPTION, 2012



ELECTRICITY CONSUMPTION, 2012

	ENERGY CONSUMPTION IN MWH	PER CAPITA CONSUMPTION
CALIFORNIA	258,683,907	6.87
REST OF U.S.	3,428,101,028	12.41

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. *Other includes Street Lighting and Mining. Data Source: California Energy Commission. Analysis: Collaborative Economics

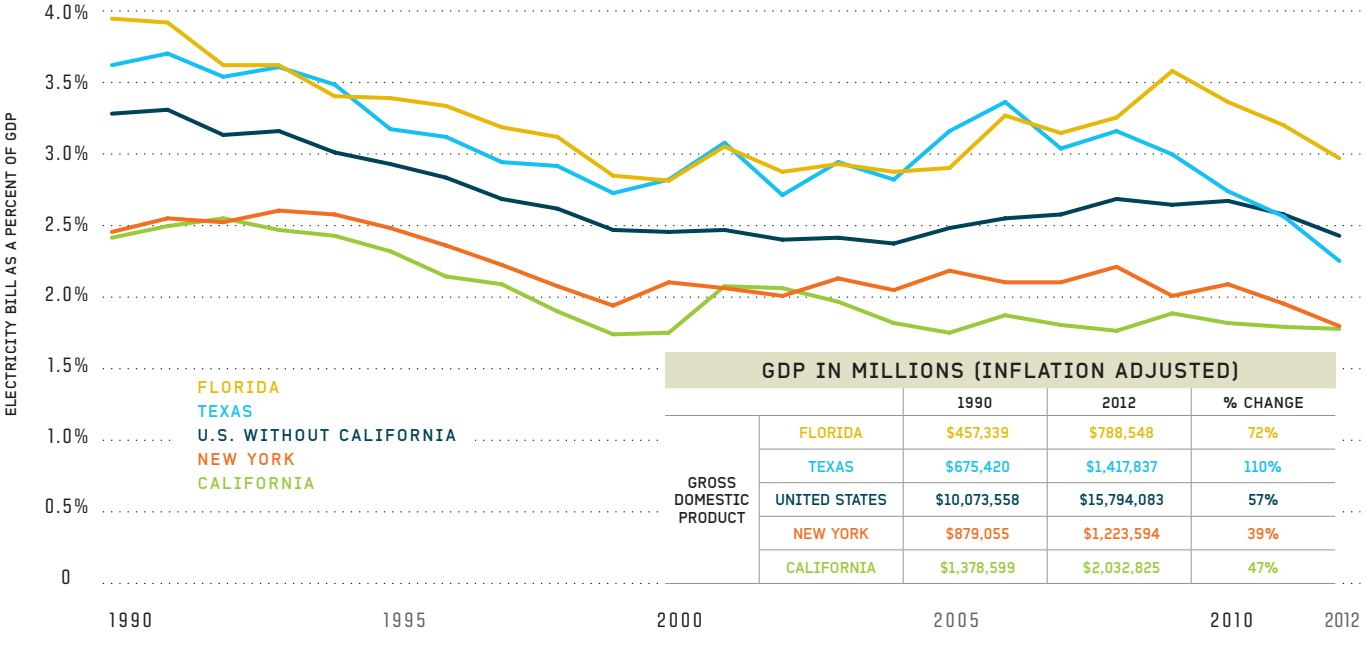
In addition to cost savings to the general economy, consumers directly benefit from California's efficiency policies. While California's average electricity rates per kilowatt-hour are higher than the U.S. and other large states, average monthly bills (inflation adjusted) in California were lower and declined more significantly from 1992 to 2012 as energy efficiency improved (Table 2). California's average monthly Residential electricity bill was 17 percent lower than the U.S. average, and Industrial bills were 25 percent less than the U.S. average in 2012. California's average Industrial electrical bill had the biggest improvement over the long term, with a 64 percent decrease from 1992 to 2012, compared to a 36 percent decline in the U.S. overall and 23 percent increase in Florida. California's average Commercial electricity bill decreased three percent between 1992 and 2012, while New York and Texas both increased (6% and 4% respectively).

TABLE 2. ELECTRICITY PRICES AND BILLS (INFLATION ADJUSTED) BY SECTOR
CALIFORNIA, NEW YORK, FLORIDA, TEXAS, AND THE U.S.

		PRICE (CENTS PER KWH)	AVERAGE MONTHLY BILL		
		2012	1992	2012	% CHANGE 1992-2012
RESIDENTIAL	CALIFORNIA	$0.16	$97.00	$90.54	-7%
	UNITED STATES	$0.12	$106.85	$108.90	2%
	NEW YORK	$0.18	$104.79	$108.15	3%
	FLORIDA	$0.12	$129.03	$125.10	-3%
	TEXAS	$0.11	$130.87	$131.17	0%
INDUSTRIAL	CALIFORNIA	$0.11	$15,852	$5,714	-64%
	UNITED STATES	$0.07	$11,866	$7,584	-36%
	NEW YORK	$0.07	$23,536	$9,194	-61%
	FLORIDA	$0.08	$5,353	$6,561	23%
	TEXAS	$0.06	$8,432	$4,864	-42%
COMMERCIAL	CALIFORNIA	$0.14	$780.86	$759.52	-3%
	UNITED STATES	$0.10	$652.76	$638.63	-2%
	NEW YORK	$0.15	$880.64	$930.06	6%
	FLORIDA	$0.10	$653.09	$646.89	-1%
	TEXAS	$0.08	$657.23	$680.31	4%

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: Energy Information Administration, U.S. Department of Energy. Inflation Adjusted. Analysis: Collaborative Economics

FIGURE 13. STATEWIDE ELECTRICITY BILL AS A PERCENT OF GDP CALIFORNIA, TEXAS, FLORIDA, NEW YORK & U.S. WITHOUT CALIFORNIA



GDP IN MILLIONS (INFLATION ADJUSTED)

		1990	2012	% CHANGE
GROSS DOMESTIC PRODUCT	FLORIDA	$457,339	$788,548	72%
	TEXAS	$675,420	$1,417,837	110%
	UNITED STATES	$10,073,558	$15,794,083	57%
	NEW YORK	$879,055	$1,223,594	39%
	CALIFORNIA	$1,378,599	$2,032,825	47%

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: U.S. Department of Energy, Energy Information Administration; Bureau of Economic Analysis, U.S. Department of Commerce. Analysis: Collaborative Economics

RENEWABLE ENERGY

California continues to leverage and protect its strong renewable energy policies. In 2013, California passed AB 327 into law to continue net energy metering, which enables small-scale solar customers to receive compensation for the electricity they deliver to the grid in excess of their personal use. The California Public Utilities Commission also passed an energy storage mandate in 2013 for the investor-owned utilities, which will help to expand the electricity grid's capacity to take on a higher percentage of electricity from intermittent renewable sources[8] (See Energy Storage Feature on page 46 for more details).

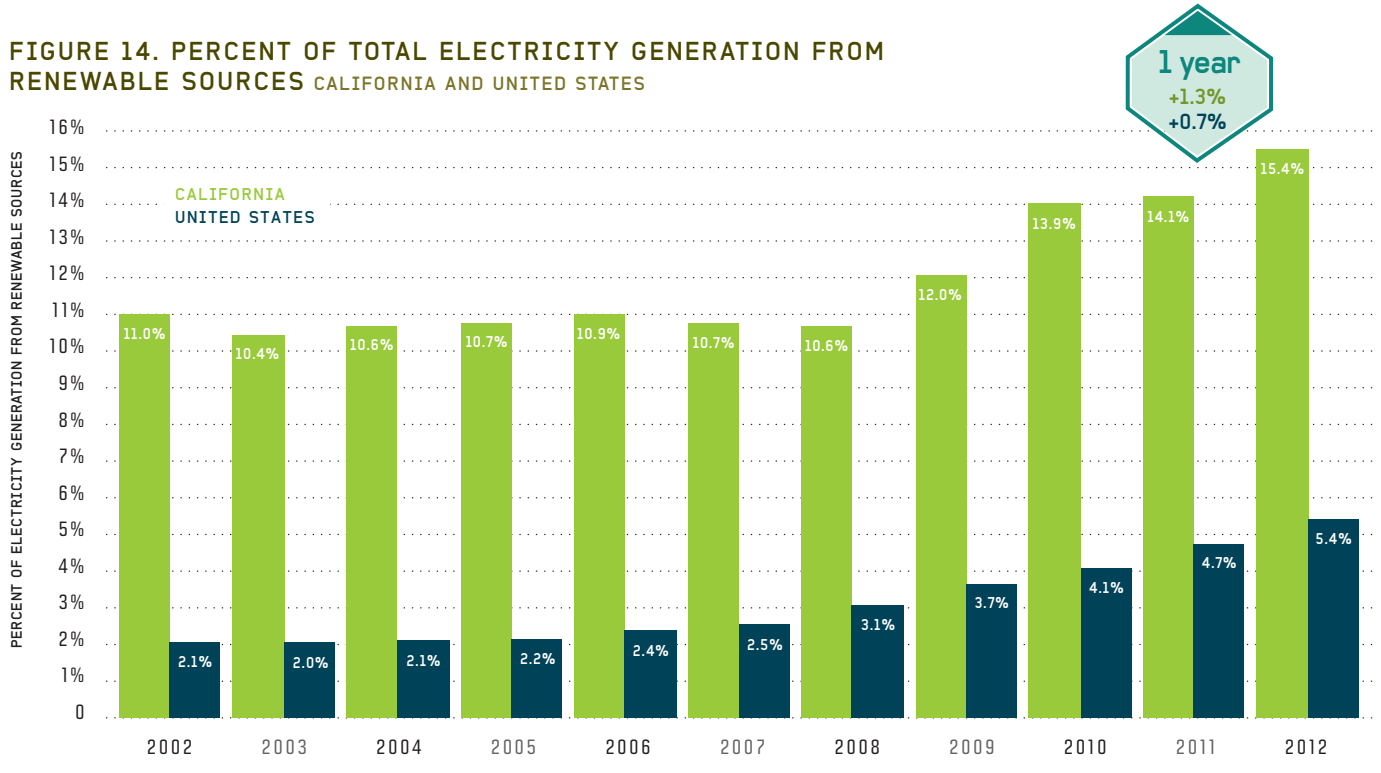
WHY IS IT IMPORTANT?

Renewable energy is an unlimited source of energy that leverages replenishable natural resources, and produces fewer emissions when compared to fossil fuel energy. Therefore, renewable energy offers a way to increase or maintain an energy supply while reducing greenhouse gas emissions and environmental impacts from energy use. Indicators that track trends in renewable energy illustrate California's shift to a cleaner energy supply.

RENEWABLE ELECTRICITY GENERATION

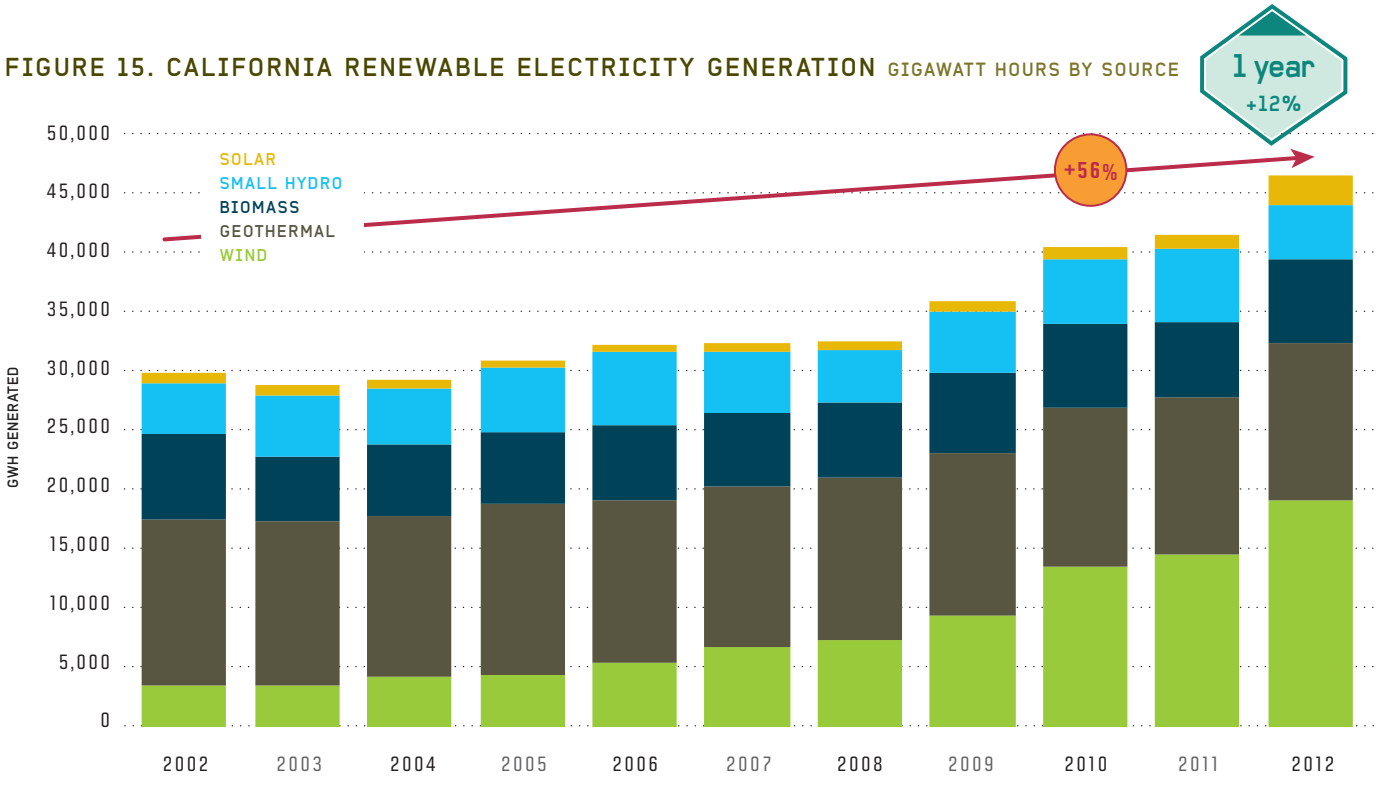
In 2012, California increased renewable electricity to reach 15.4 percent of total electricity generation, up 1.3 percentage points compared to 2011 (Figure 14). The U.S. experienced a slower increase of 0.7 percentage points compared to 2011 and trails California with only 5.4 percent of total electricity generation from renewable sources in 2012.

FIGURE 14. PERCENT OF TOTAL ELECTRICITY GENERATION FROM RENEWABLE SOURCES CALIFORNIA AND UNITED STATES



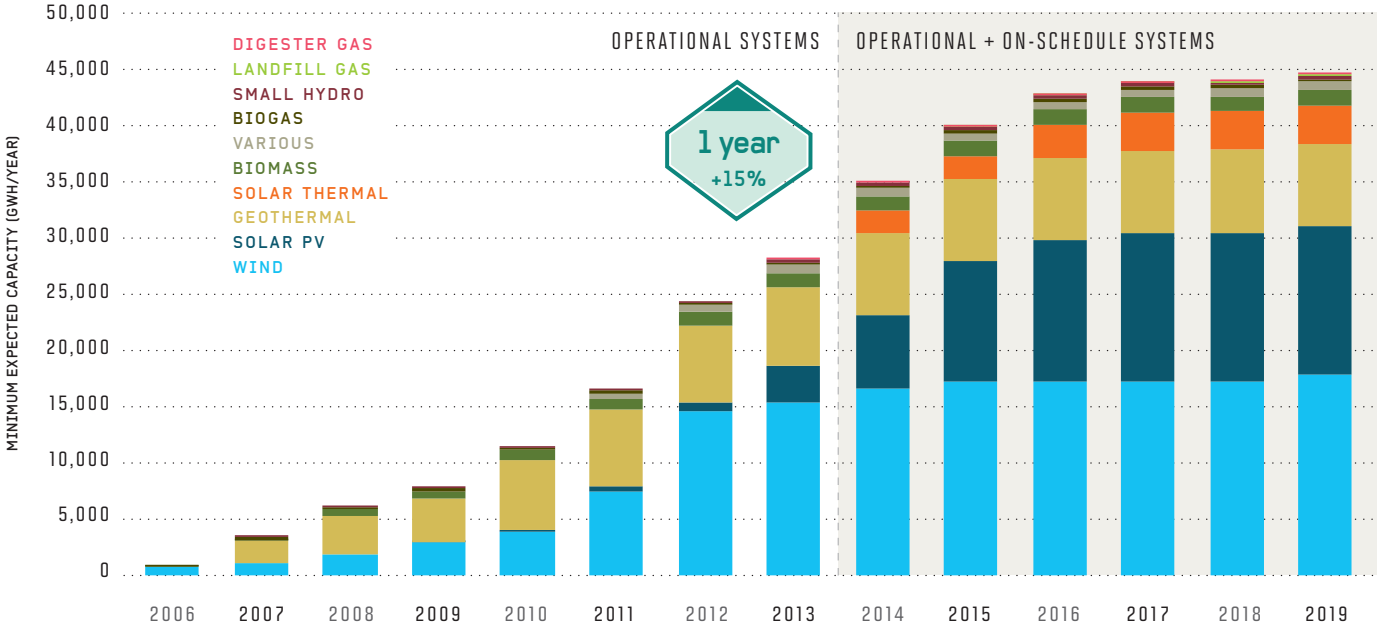
NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Renewables do not include large hydro. Data Source: California Energy Commission; Energy Information Administration, U.S. Department of Energy. Analysis: Collaborative Economics

FIGURE 15. CALIFORNIA RENEWABLE ELECTRICITY GENERATION GIGAWATT HOURS BY SOURCE



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Energy Commission. Analysis: Collaborative Economics

FIGURE 16. CUMULATIVE OPERATIONAL CAPACITY OF RENEWABLES PORTFOLIO STANDARD PROJECTS BY INVESTOR-OWNED UTILITIES CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Public Utilities Commission. Analysis: Collaborative Economics

California's renewable electricity generation surged 56 percent between 2002 and 2012, reaching roughly 46,500 gigawatt hours (GWh) (Figure 15). The largest increase came from wind energy, which was more than five times higher in 2012 compared to 2002. Solar was still a relatively small proportion of total renewable generation in 2012 (5.6% of total), though it was the second fastest growing and tripled in the last decade. Wind comprised the largest proportion of renewable electricity generation (41%) in 2012, followed by geothermal (28%) and biomass (15%). In the most recent year, renewable electricity increased 12.2 percent overall, with the biggest jumps in solar (+111%), followed by wind (+31%), while small hydro dropped 27.5 percent.

To achieve its Renewable Portfolio Standard goal of 33 percent of electricity generation from renewables by 2020, California investor-owned utilities are poised to increase renewable electricity generation by about 60 percent between 2013 and 2020, as illustrated in the operational and on-schedule system capacity in Figure 16. In the last five years, the utilities increased renewable generation primarily through wind energy, which jumped five-fold between 2009 and 2013, and is expected to increase by another 16 percent by 2020 to a total of nearly 18,000 GWh. Between 2012 and 2013, solar PV had the biggest increase with nearly 4.5 times more generation capacity in 2013 due primarily to a few large plants that came online during the year. Solar PV and solar thermal are expected to play a key role in meeting the renewable goal, adding a combined total of over 13,000 GWh between 2013 and 2020.

WIND AND SOLAR INSTALLATIONS

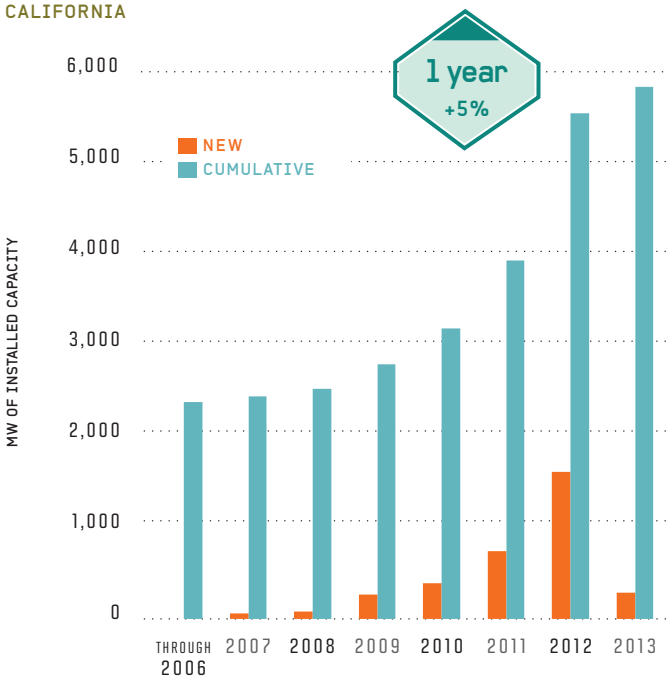
California is expanding renewable energy installations and, as the market matures, is doing so at a cost that is increasingly competitive with fossil fuel energy. For example, one study found that the cost of land-based wind energy projects decreased 90 percent since 1980 and can be more affordable to build and operate than a conventional coal plant for new electricity generation.[9] Solar is also increasingly affordable and the price of utility-scale solar photovoltaic (PV) dropped from 21.4 cents per kWh in 2010 to 11.2 cents per kWh in 2013.[10] These cost reductions have helped fuel rapid market growth in renewable energy across the U.S. and in California.

California's wind capacity continued to increase in 2013, up five percent compared to 2012 to reach about 5,800 MW of total capacity (Figure 17). New installations dropped noticeably in 2013, with less than 300 MW added in California, though still a large percentage of the 1,084 MW total installed across the U.S. in 2013. This dramatic drop is largely due to uncertainty around federal tax incentives. The federal Renewable Electricity Production Tax Credit and Investment Tax Credit expired briefly at the end of 2012, and the uncertainty of renewal prompted a surge in installations in 2012 to take advantage of the incentives before they expired.[11] Though the tax credits were renewed, the shift forward of demand into 2012, and the policy uncertainty leading into 2013, deterred investors and project developers from installing in 2013. California remains second in the nation for overall installed wind capacity, behind Texas with over 12,000 MW and ahead of Iowa with about 5,200 MW at the end of 2013.

California also installed a record 2,746 MW of solar power in 2013, about 2.6 times more new installations than in 2012, up 163 percent from the previous year (Figure 18). These installations included large utility-scale solar plants, municipal utility installations, and smaller projects installed

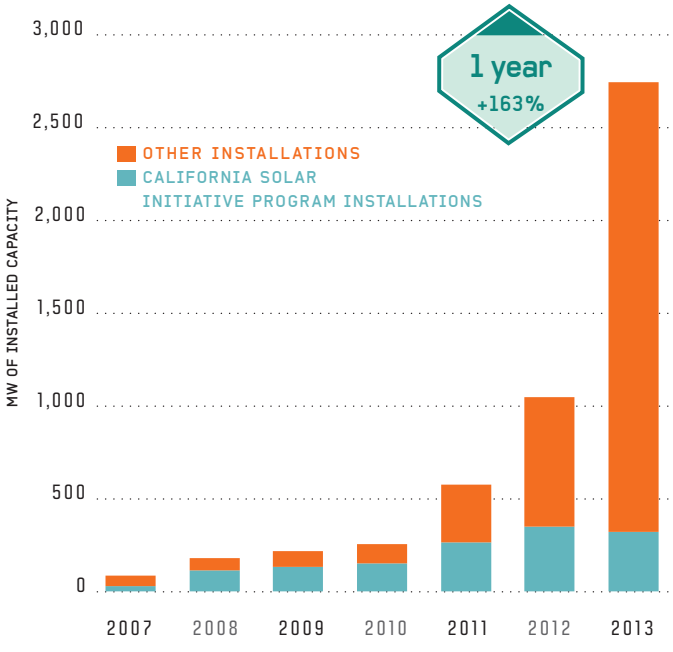
FIGURE 17. WIND ENERGY INSTALLATIONS

CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: American Wind Energy Association. Analysis: Collaborative Economics

FIGURE 18. NEW SOLAR INSTALLATIONS CALIFORNIA

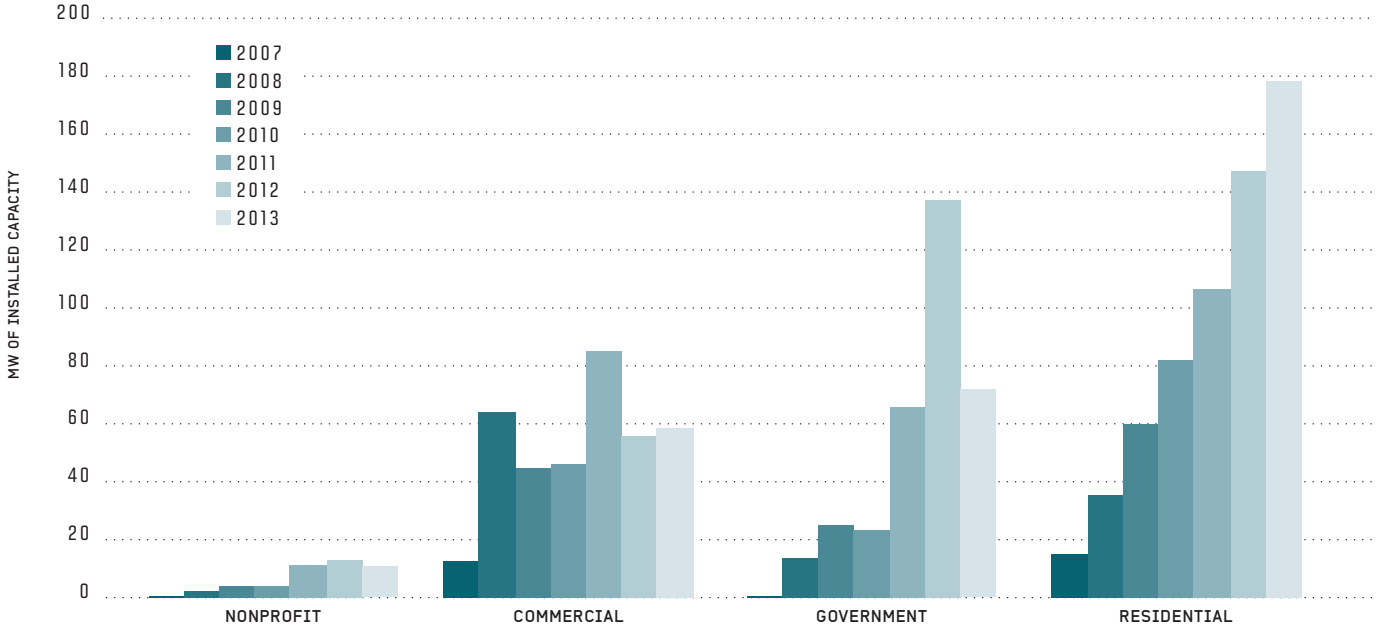


NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Public Utilities Comission - California Solar Initiatve, and Solar Energy Industries Association and GTM Research. Analysis: Collaborative Economics

through the California Solar Initiative, the investor-owned utility solar rebate program. Larger, non-California Solar Initiative projects drove new installations in 2013, with 3.5 times more installed in 2013 compared to 2012.

California continued to close the gap towards its goal of installing 1,940 MW through the California Solar Initiative by the end of 2016, with a cumulative total of 1,380 MW installed as of the end of 2013. New solar installations through the rebate program were about 320 MW in 2013, a nine percent decrease from 2012. In the longer term, solar installations through the program rose dramatically, with over 11 times more annual capacity installed in 2013 than in 2007 when the program began. Figure 19 shows that the Residential sector continued to be the largest sector for solar installations, with about 179 MW installed in 2013, a 21 percent increase compared to 2012. The Government sector was the next largest in 2013 installations with nearly 72 MW, though sector installations were down 48 percent from 2012. The Commercial sector was the other sector that grew compared to 2012, with a six percent increase to about 59 MW installed in 2013. The Nonprofit sector made up the remainder of the installations through the California Solar Initiative, with a 19 percent decrease in 2013 to about 10.7 MW.

FIGURE 19. NEW SOLAR INSTALLATIONS BY SECTOR INSTALLATIONS THROUGH THE CALIFORNIA SOLAR INITIATIVE / CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Public Utilities Comission - California Solar Initiatve. Analysis: Collaborative Economics

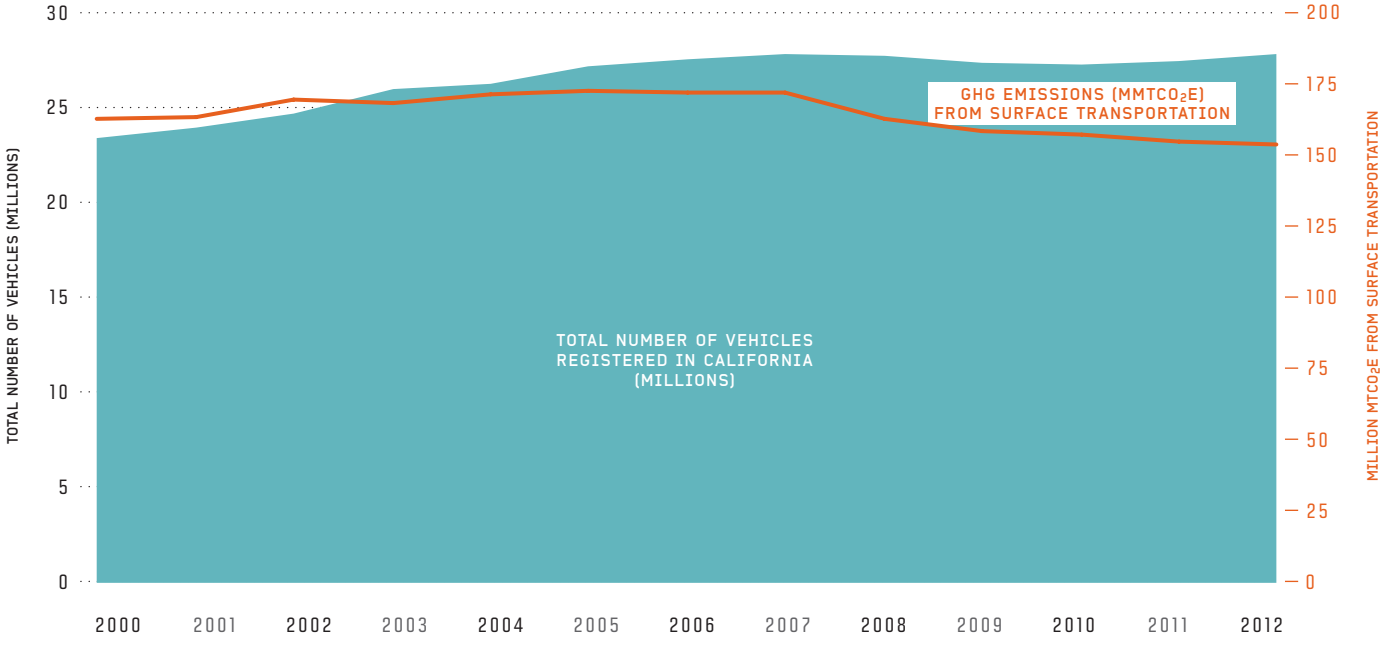
TRANSPORTATION

California continues to lead the country in transportation efficiency and has some of the most comprehensive transportation and land-use planning policies in the country.[12] California was the first state to adopt policies to reduce carbon emissions from vehicles, and first passed the Clean Cars Program in 2004, which impacts vehicle emissions through model year 2016. In 2012, the California Air Resources Board voted to adopt an updated Advanced Clean Cars Program, which extends through model year 2025. In addition, the state's Low Carbon Fuel Standard established in 2007 will reduce the carbon pollution from gasoline and diesel by ten percent by 2020. In 2013, Governor Brown continued to move the state towards the goal of 1.5 million zero-emission vehicles (ZEVs) and supporting infrastructure operating in the state by 2025 (B-16-12) by releasing an action plan to implement this goal.[13] In addition, Governor Brown signed an agreement with

WHY IS IT IMPORTANT?

California's transportation network of highways, railways, and shipping and aviation routes facilitates economic activity and improves travel convenience for residents and companies. But it also takes a vast amount of energy to fuel vehicles, and most vehicles are still reliant on petroleum. In California alone, the transportation sector accounts for more than a third of the state's greenhouse gas emissions. Therefore, it is important to measure progress in making trips more efficient and the adoption of alternative fuel vehicles that will reduce emissions.

FIGURE 20. TOTAL VEHICLES AND GREENHOUSE GAS EMISSIONS CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Total number of vehicles are for all vehicles registered in California including cars and trucks. Data Source: California Air Resources Board, California Greenhouse Gas Inventory - by Sector and Activity; California Energy Commission. Analysis: Collaborative Economics

seven other states to cooperate on policies and standards to facilitate implementation of ZEVs.[14]

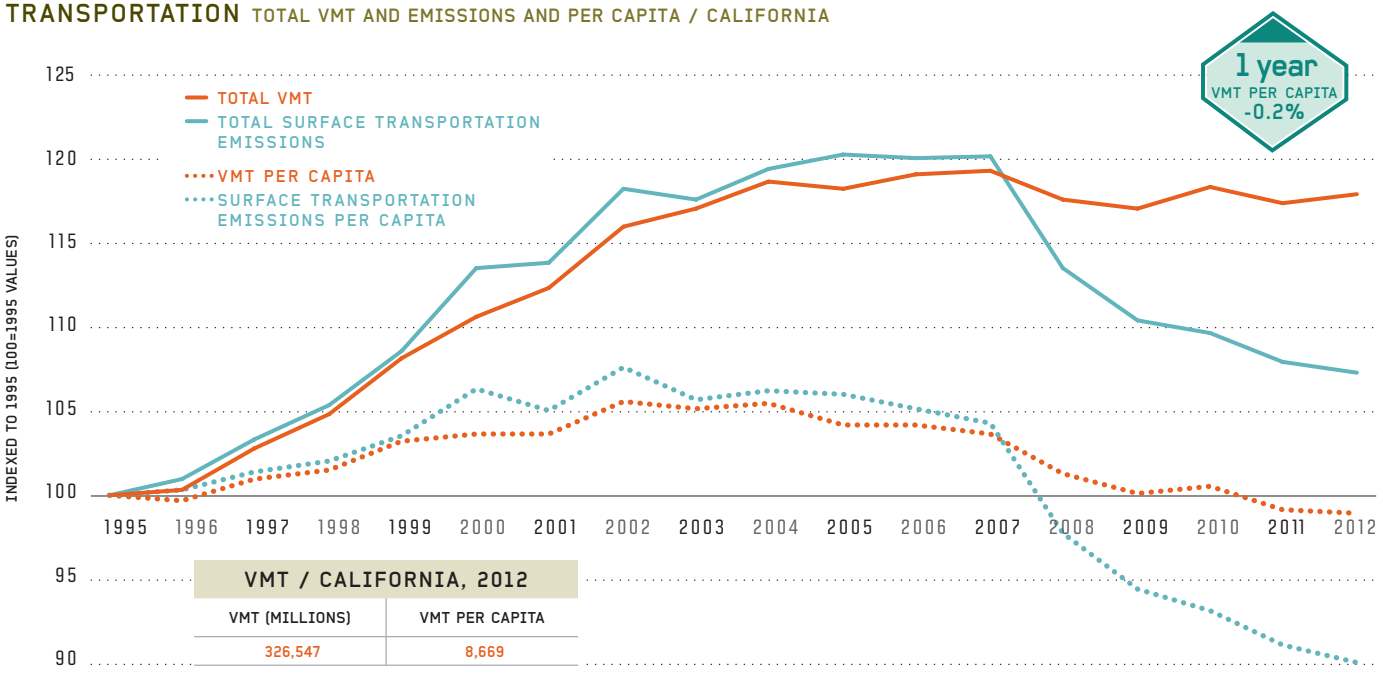
California regions are developing innovative transportation technologies and capturing the economic benefits. For example, the California Energy Commission recently funded a consortium of Southern California-based organizations to establish a Southern California Center for Alternative Fuels and Advanced Vehicle Technology. The Center will help the eight-county Southern California region design and produce lower-emission technologies and advance the adoption of alternative fuels and advanced vehicle technologies, with the goal of building the advanced transportation cluster and creating local jobs.[15] The University of California at Davis' Plug-in Hybrid & Electric Vehicle Research Center is also pushing innovative research forward, as well as providing technology and policy guidance to the state.

Since 2007, California has steadily decreased greenhouse gas emissions from surface transportation sources, including light- and heavy-duty vehicles. While overall emissions increased in 2012, transportation emissions declined 0.6 percent compared to 2011 (Figure 20). This emissions decrease was achieved while total vehicle registrations in the state increased 1.5 percent.

Total vehicle miles traveled (VMT) increased slightly in 2012 compared to 2011 (+0.5%), though VMT per person continued to decrease (-0.2%) (Figure 21). This trend of declining VMT per capita aligns with a recent study that shows the rate of Californians using low or emissions-free transportation (e.g. walking, biking, transit) on an average day doubled to 22 percent between 2001 and 2011, while the rate of daily driving fell 12 percentage points over the same time.[16] California's move towards alternative modes of transportation also aligns with a decrease in greenhouse gas emissions from transportation, illustrated by a 1.2 percent drop in per capita transportation emissions between 2011 and 2012.

California's progressive policies are showing results through increased market demand for more efficient, alternative fuel vehicles. Alternative fuel vehicles include ZEVs, such as electric and hydrogen fuel cell, and low-emission vehicles such as hybrid gasoline, natural gas, and propane vehicles. California

FIGURE 21. VEHICLE MILES TRAVELED AND GREENHOUSE GAS EMISSIONS FROM SURFACE TRANSPORTATION TOTAL VMT AND EMISSIONS AND PER CAPITA / CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory - by Sector and Activity; California Department of Transportation; California Department of Finance. Analysis: Collaborative Economics

drivers are increasingly adopting alternative fuel vehicles, with 16 percent more registrations in 2012 than 2011, while overall registrations increased only 1.5 percent. Of this incremental increase in overall registrations, 23 percent were alternative vehicles, most of which were hybrid gasoline vehicles. California added nearly 91,000 alternative fuel vehicles in 2012 alone, reaching a total of nearly 650,000 vehicles, or 2.3 percent of total vehicle registrations in the state (Figure 22). In recent years this share steadily increased and is up from 1.6 percent in 2009 (Table 3).

Zero Emission Vehicles specifically had the fastest rate of increase in recent years, driven in part by the state's ZEV goal, interstate agreements, and California's Clean Vehicle Rebate Project. The rebates of up to $2,500 each help businesses and individuals purchase a light duty ZEV and reduce the price differential between conventional vehicles, and cleaner alternative vehicles. ZEV registrations jumped 62 percent between 2011 and 2012, while alternative fuel vehicles overall rose 16 percent (Table 4). This growth in ZEVs primarily came from an eight-fold increase in plug-in hybrid vehicles. Electric vehicles were still the largest ZEV category with over 24,000 vehicles as of 2012, a 20.6 percent increase compared to 2011.

TABLE 3. ALTERNATIVE FUEL VEHICLES AS A PERCENTAGE OF TOTAL VEHICLES REGISTERED

CALIFORNIA

2000	0.03%
2009	1.60%
2012	2.30%

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Energy Commission. Analysis: Collaborative Economics

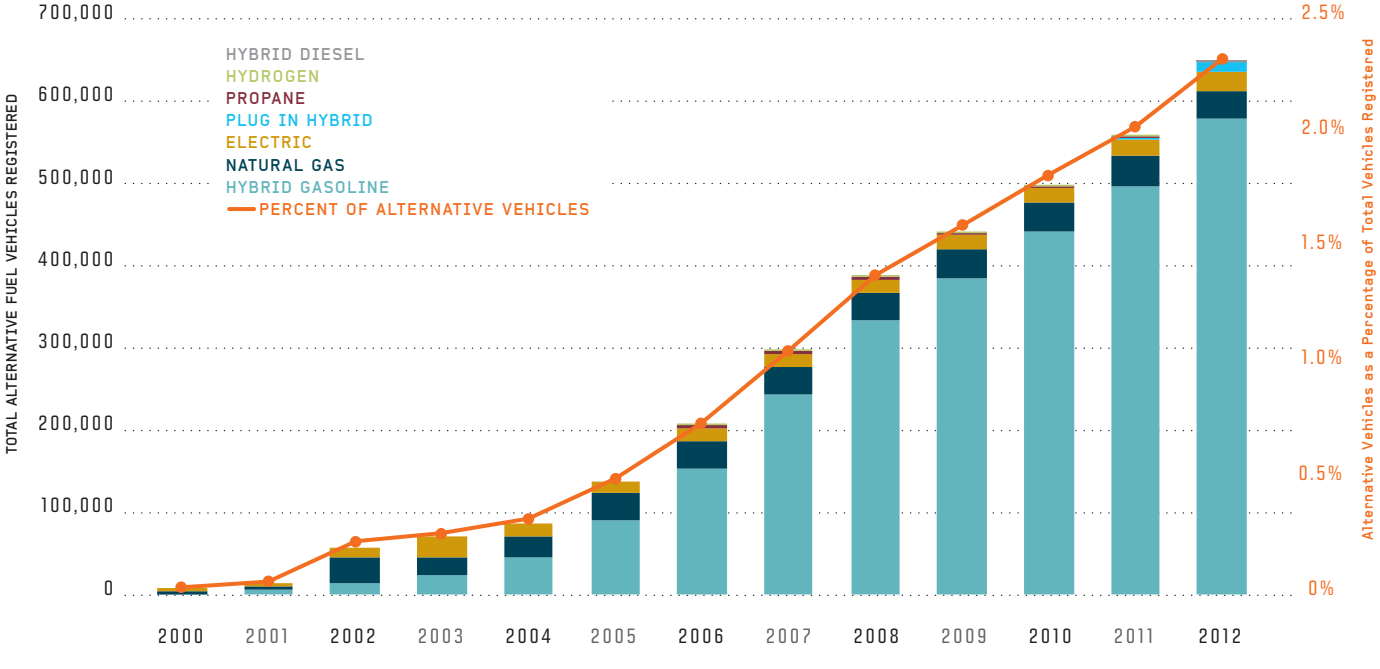
TABLE 4. ALTERNATIVE FUEL VEHICLE AND ZERO EMISSION VEHICLE REGISTRATIONS

CALIFORNIA

	% CHANGE 10-12	% CHANGE 11-12
ELECTRIC	+43.8%	+20.6%
PLUG-IN HYBRID	N/A	+685.0%
NATURAL GAS	-6.8%	-10.3%
HYBRID	+31.0%	+16.7%
HYDROGEN	+350.0%	+70.5%
PROPANE	-52.3%	-49.2%
TOTAL ALTERNATIVE FUEL VEHICLES	+30.0%	+16.0%
TOTAL ZERO EMISSION VEHICLES	+106.0%	+62.0%
TOTAL VEHICLES	+2.1%	+1.5%

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Zero Emission Vehicles include electric, plug-in hybrid, and hydrogen vehicles. Data Source: California Energy Commission. Analysis: Collaborative Economics

FIGURE 22. TRENDS IN ALTERNATIVE FUEL VEHICLE REGISTRATIONS CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Energy Commission. Analysis: Collaborative Economics

CLEAN TECHNOLOGY INNOVATION

INVESTMENT IN CLEAN TECHNOLOGY

Investment fuels clean technology innovation, allowing companies and researchers to create and improve new, ground-breaking products and services. In the last few years, venture funding for clean technology companies has ebbed, following an investment hype in clean technologies in 2008-2011. Despite this recent decline, companies are still emerging and receiving investment, many creating new technologies with lower capital needs than traditional manufacturing, such as "cleanweb" software-based companies that help improve efficiencies and analysis in multiple segments. In addition, different types of investors, such as corporations, have surfaced and are playing key roles in the sector.

Total investment in California clean technology companies declined 53 percent in 2013 compared to 2012, reaching $1.66 billion (Figure 23). This investment includes venture capital, loans (debt), and grants from public and private sources. While total investment was down, the sources of financing continued to be more diverse compared to five years prior. Corporate venture capital, for example, played a more prominent role in clean technology companies in recent years. Corporations were involved in 43 percent of total venture capital invested in 2013 compared to 34 percent in 2009. Corporations are important investors because they can provide strategic market power and longer-term investment horizons, as well as critical investment capital. In turn, corporations gain access to new and innovative technologies to provide to their customers.[17]

Since 2006 when clean technology investment began to rise, investors put a total of more than $27 billion of venture capital and other financing into California clean technology companies. This early investment in the sector helped companies experiment with new technologies and services, and companies are now harvesting the benefits of that innovation through more efficient and affordable technologies. Renewable energy and alternative fuel vehicles, for example, cost less and are more reliable in 2013 than in 2006 and consumers are increasingly demanding these types of products. In addition, companies are specializing and creating new business models to capitalize on these lower cost technologies, such as solar leasing companies like SolarCity and SunRun. While direct investment declined in recent years, other indicators, such as renewable installations and energy efficiency, show that consumers are capitalizing on this more mature market and fueling demand for clean technologies, which will continue to draw investors to capitalize on this opportunity.

In addition to direct investment in companies, corporations and investors continued to invest in clean technology projects in 2013. For example, Google has over 15 investments totaling more than $1 billion in wind and solar projects, including multiple projects in California.[18] Hedge funds and private equity companies, such as D.E. Shaw & Co. and KKR & Co., are also increasing renewable energy project investments, lured by projected yields of 8-10 percent in the next few years.[19] Public clean technology companies

WHY IS IT IMPORTANT?

While technologies and businesses of today are helping California make the shift from a carbon-based to a cleaner and more efficient economy, new innovations are critical for California to achieve its greenhouse gas reduction goals. Financial investments in clean technology companies help to research, commercialize, and scale new products and services, which positions California on the leading edge of the market. Similarly, patent registrations are one measure of knowledge accumulated through private and public investment in research and development, and represent potential growth in the clean technology sector in the future. Looking at changes in clean technology investments and patents together can illustrate California's role in leading the shift to a clean economy.

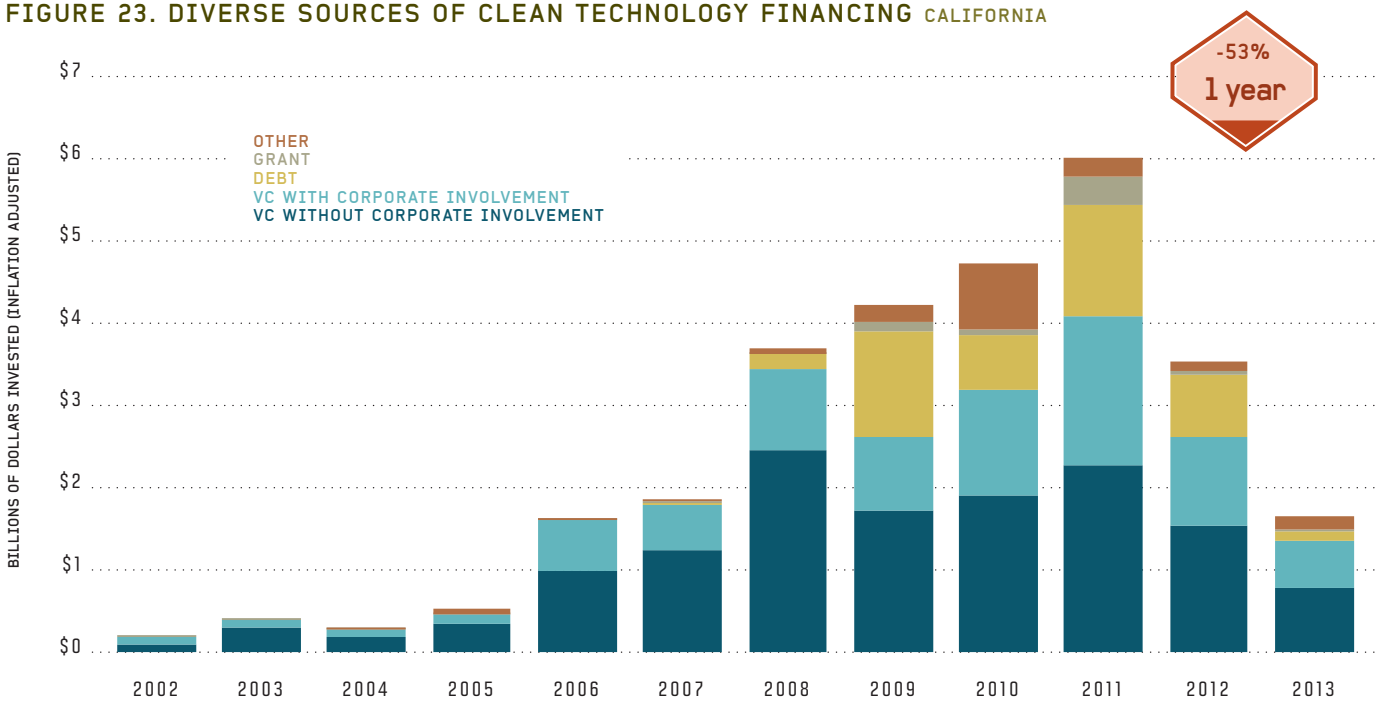
are also attracting investors, including Tesla Motors Inc. who raised $2 billion in convertible notes from bond investors in February 2014 to finance a new battery factory.[20] The public is also increasingly able to directly invest in clean technology companies and solar projects through crowdfunding platforms like Kickstarter and Mosaic.

Venture capital remains an important source of funding, as venture capitalists are generally more willing to enter early into innovative sectors and accept higher risk investments. In 2013, total venture capital across all sectors in California was up six percent from 2012 to $16.6 billion, while clean technology venture capital was down 47 percent to $1.4 billion (Figure 24). Despite this recent change, clean technology remained a notable part of the California venture capital field, accounting for nine percent of total venture capital in 2013.

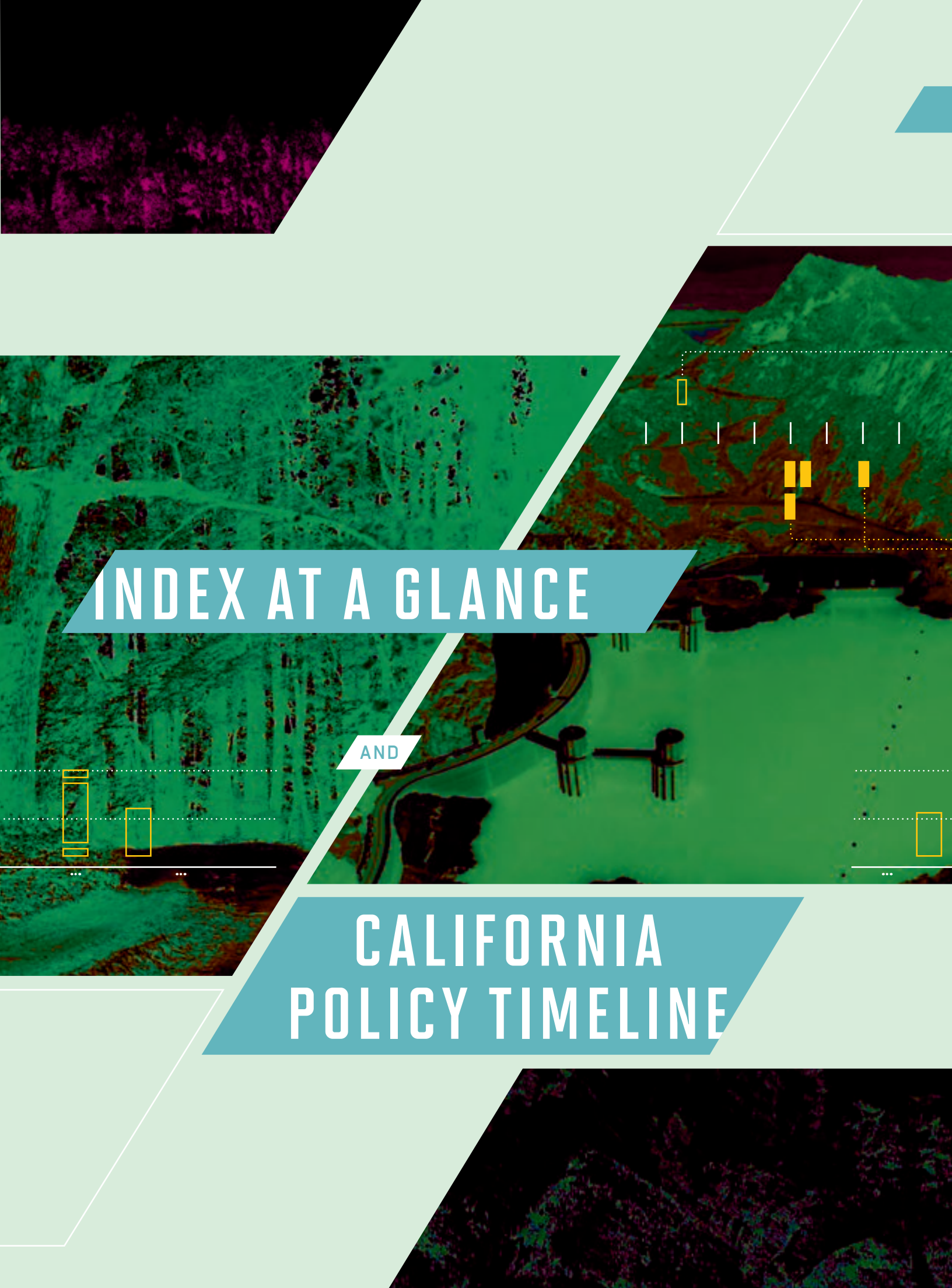
Mirroring California, U.S. clean technology venture capital decreased as a whole in 2013, dropping 41 percent to a total of $3 billion (Figure 25). Worldwide clean technology venture capital decreased at a slower rate, down 15 percent to $6.8 billion. California continued to comprise the majority (48%) of clean technology venture capital in the U.S. Texas came in second with about $380 million in 2013, while Massachusetts was third with about $310 million.

California clean technology venture capital is diversifying across segments and was more evenly spread across multiple segments in 2013 compared to previous years (Figure 26). Energy Generation returned to its position as the largest segment in terms of venture capital with about $350 million in 2013, though was less dominant, with only 25 percent of total venture capital in 2013 compared to 38 percent of the total in 2009. Clean transportation was the second largest segment in 2013 with more than $250 million. Four segments saw increases in venture capital investment between 2012 and 2013, including Air & Environment, Recycling & Waste, Green Building, and Energy Infrastructure. The total number of clean technology venture capital deals fell at a slower rate of 30 percent between 2012 and 2013, compared to the funding level decrease of 47 percent, as the average deal size decreased for the second year in a row.

FIGURE 23. DIVERSE SOURCES OF CLEAN TECHNOLOGY FINANCING CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: "Other" type of investment includes PIPE, private equity, angel, convertible notes, corporate minority, unattributed, other, and partnership
Data Source: CB Insights. Analysis: Collaborative Economics



INDEX AT A GLANCE

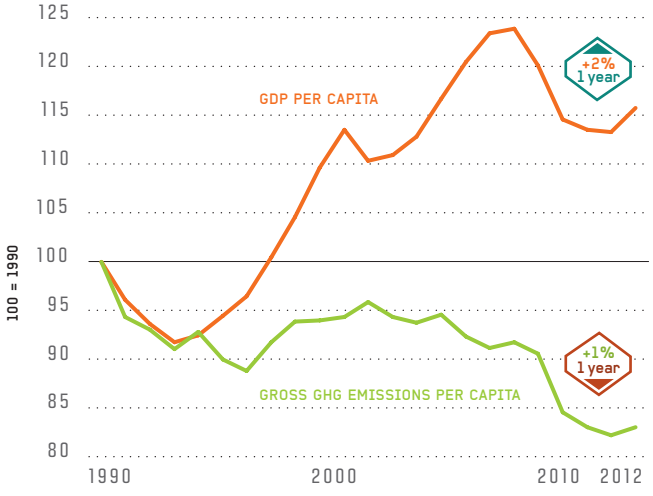
AND

CALIFORNIA POLICY TIMELINE

INDEX AT A GLANCE

THE CARBON ECONOMY: CALIFORNIA RANKS AMONG THE MOST EFFICIENT AND LEAST CARBON INTENSIVE ECONOMIES IN THE WORLD, REDUCING GREENHOUSE GAS EMISSIONS WHILE STILL INCREASING ECONOMIC OUTPUT.

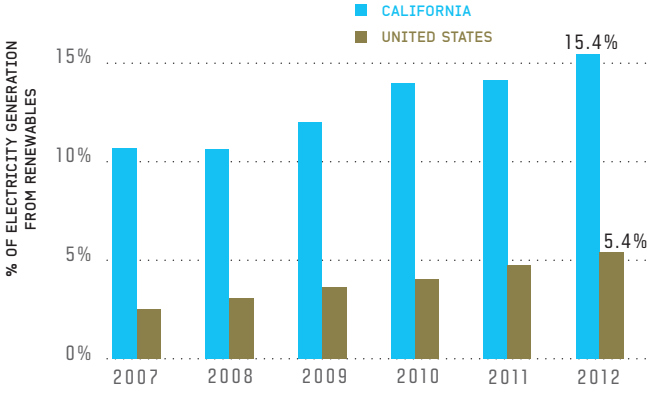
GDP & EMISSIONS _PAGE 6



Emissions per capita had a slight one percent uptick in 2012 compared to 2011 following an increase in total emissions, though improved in the longer term with a 17 percent drop since 1990. California became more carbon efficient while it increased economic output, with GDP per person up 2.2 percent since 2011 and 16 percent since 1990.

RENEWABLE ENERGY: THROUGH ITS COMMITMENT TO RENEWABLE ENERGY, CALIFORNIA REMAINS AT THE FOREFRONT OF THE NATION ON RESULTS SUCH AS SOLAR INSTALLATIONS AND GENERATION CAPACITY.

RENEWABLES _PAGE 18



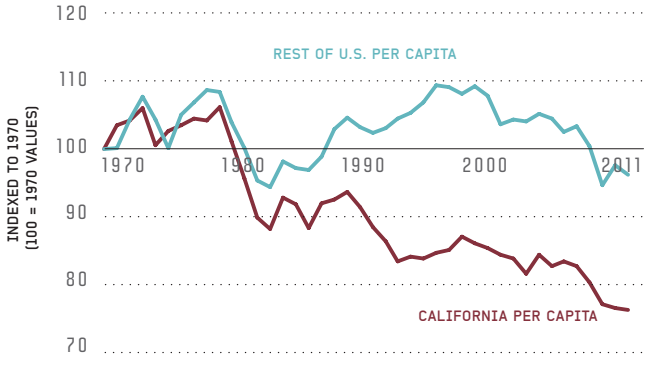
California has broken its renewable electricity share every year since 2008, and reached a new high in 2012 with 15.4 percent of total electricity generation, about three times the percentage of the U.S. as a whole. California renewable electricity increased 1.3 percentage points in the last year alone.

1 year
+1.3%
+0.7%

ENERGY EFFICIENCY: CALIFORNIA'S EARLY AND SUSTAINED ADOPTION OF ENERGY POLICIES HAS GENERATED LARGE IMPROVEMENTS IN ENERGY EFFICIENCY AND LOWERED ENERGY BILLS FOR CONSUMERS.

ENERGY CONSUMPTION _PAGE 12

TOTAL ENERGY CONSUMPTION RELATIVE TO 1970



California's per capita energy consumption has dropped a dramatic 24 percent since 1970. The rest of the U.S., in contrast, fell only four percent over the same period. Between 2010 and 2011, California decreased 0.4 percent, while the rest of the U.S. dropped 1.4 percent.

1 year
PER CAPITA
-1.4%
-0.4%

TRANSPORTATION: CALIFORNIA DRIVERS ARE INCREASINGLY ADOPTING FUEL EFFICIENT AND ALTERNATIVE FUEL VEHICLES.

ALTERNATIVE FUEL AND ZERO EMISSION VEHICLE REGISTRATIONS, CALIFORNIA _PAGE 22

PERCENT CHANGE 2011-2012	
ELECTRIC	+20.6%
PLUG-IN HYBRID	+685%
NATURAL GAS	-10.3%
HYBRID	+16.7%
HYDROGEN	+70.5%
PROPANE	-49.2%
TOTAL ALTERNATIVE FUEL VEHICLES	+16%
TOTAL ZEV	+62%
TOTAL VEHICLES	+1.5%

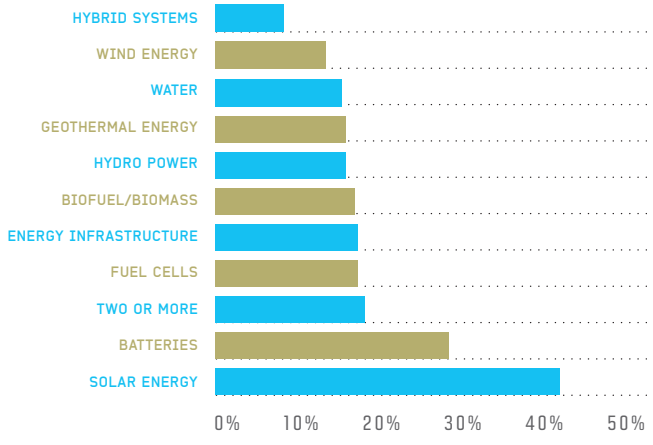
Alternative fuel vehicles comprised 2.3 percent of total registrations in California in 2012. Between 2011 and 2012, registrations of electric vehicles were up 20.6 percent and plug-in hybrid vehicles had an eight-fold increase.

CLEAN TECHNOLOGY INNOVATION:

CALIFORNIA CONTINUES TO BE THE LEADER IN CLEAN TECHNOLOGY INNOVATION, WITH ITS COMPANIES RECEIVING THE MOST INVESTMENT AND RANKING HIGHEST IN U.S. PATENT REGISTRATIONS.

CA CLEAN TECHNOLOGY PATENTS _PAGE 25

CA % OF U.S. PATENTS, 2012-2013



California maintained its national leadership in clean technology patent registrations, achieving the highest or second highest number of registrations compared to other states in all segments. California registered 43 percent of the country's solar patents and 29 percent of the nation's battery patents.

ENERGY STORAGE OPPORTUNITY:

CALIFORNIA IS POISED TO CAPITALIZE ON THE ENERGY STORAGE MARKET OPPORTUNITY AND IS ALREADY LEADING THE NATION IN DEPLOYMENT AND INNOVATION.

ENERGY STORAGE OPPORTUNITY _PAGE 46

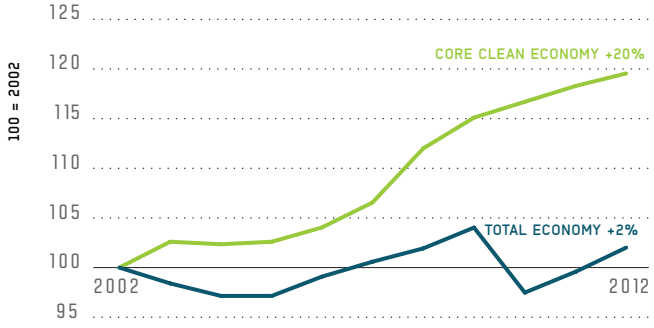
ENERGY STORAGE DEPLOYMENT IN TOP U.S. STATES

RANKING	STATE	TOTAL IN MW
1	CALIFORNIA	481.78
2	TEXAS	333.60
3	ALABAMA	110.00
4	ALASKA	56.00
5	WEST VIRGINIA	35.02
6	HAWAII	28.43
7	NEW YORK	20.36
8	PENNSYLVANIA	10.60
	U.S. TOTAL	1107.69

EMPLOYMENT IN THE CORE CLEAN ECONOMY:

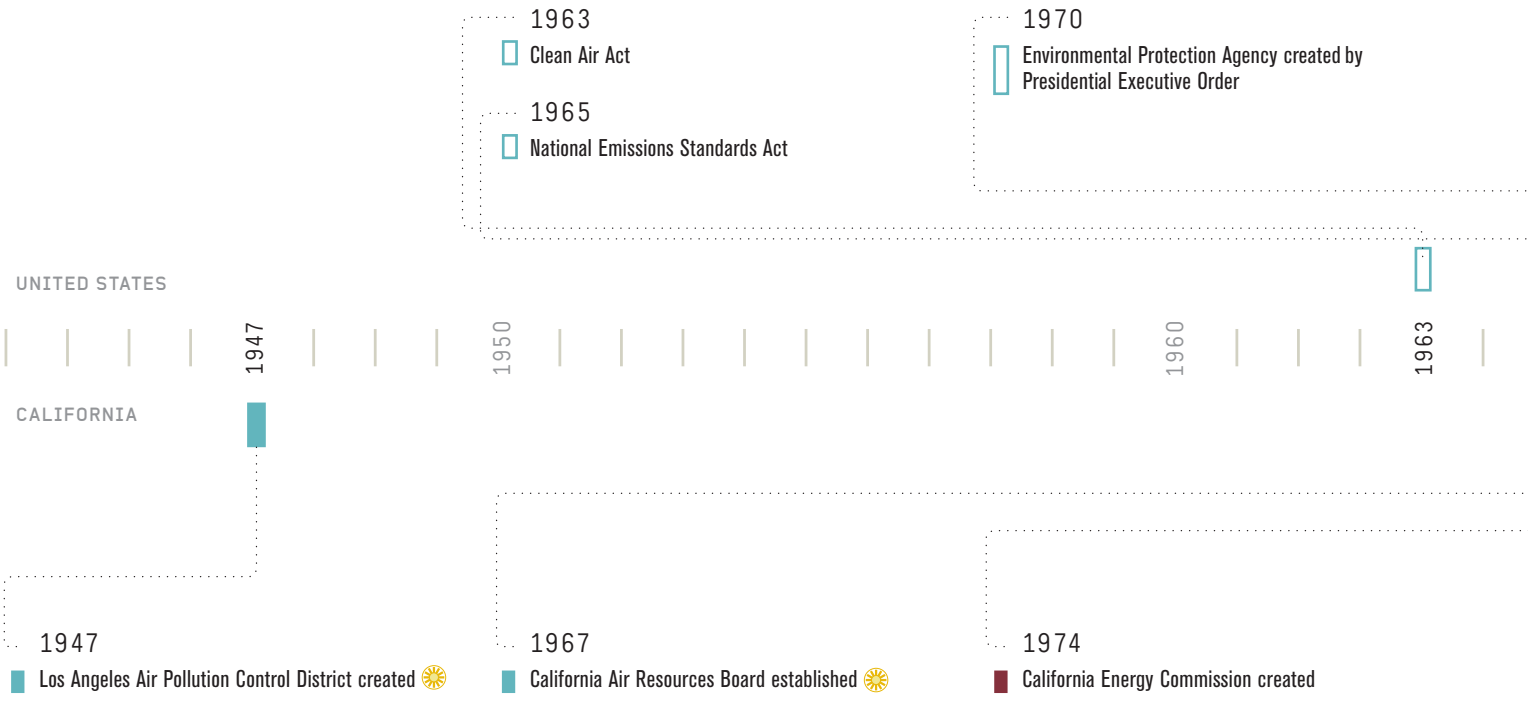
CALIFORNIA'S POLICIES, INVESTMENTS, AND MARKET FORCES CONTINUE TO DRIVE GROWTH IN THE CLEAN ECONOMY, CREATING JOBS IN ACTIVITIES RANGING FROM RESEARCH TO INSTALLATION, AND BUSINESSES IN A VARIETY OF AREAS SUCH AS WATER EFFICIENCY AND BIO-BASED ADVANCED MATERIALS.

EMPLOYMENT GROWTH _PAGE 40

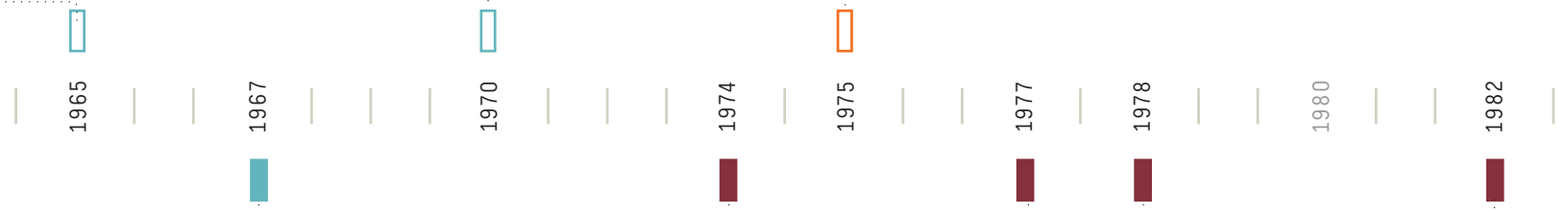


California's Core Clean Economy (in terms of jobs) grew faster than the economy as a whole in the last decade, up 20 percent between January 2002 and January 2012, while the total economy increased only two percent. Since January 2011, employment in the total economy continued its rebound from the recession with a two percent increase, while the Core Clean Economy increased about one percent.

CALIFORNIA POLICY TIMELINE



- AIR & ENVIRONMENT
- RENEWABLE ENERGY
- ENERGY EFFICIENCY
- CLEAN TRANSPORTATION
- FIRST IN U.S.



1975

Congress enacts the Corporate Average Fuel Economy (CAFE) regulations to improve average fuel economy of cars and light trucks in the U.S.

1987

National Appliance Energy Conservation and Efficiency Act

2003

West Coast Governors launch the Global Warming Initiative (CA, OR, WA)

1977

Efficiency standards for appliances (Title 20)

1978

Efficiency standards for new buildings (Title 24)

1982

California Public Utilities Commission (PUC) orders separation of electricity sales from revenues for the investor owned utilities, which removes barriers to energy efficiency investments (decoupling)

2000

California Climate Action Registry established (SB 1771)

2000–01

California energy crisis

2001

Flex Your Power initiated

2002

California passes the state's first Renewable Portfolio Standard (RPS), requiring 20% of total electricity procured from renewables by 2017 (SB 1078)

California sets standards for emissions of CO_2 & other greenhouse gases from autos and light duty trucks (Pavley Act)

2006

California Global Warming Solutions Act of 2006 (AB 32)

California greenhouse gas performance standards for power plants (SB 1368)

California Solar Initiative established out of the Governor's "Million Solar Roofs" vision to provide a solar rebate for California consumers (SB 1)

2007

Governor Schwarzenegger establishes Low Carbon Fuel Standard regulations to reduce carbon intensity of transportation fuel 10% by 2020 (S-01-07)

California legislation establishes a fund for clean vehicle and equipment projects and provides incentives to develop and deploy innovative technologies in support of the state's greenhouse gas goals (AB 118)

2008

California PUC approves feed-in tariff to incentivize the development of small-scale solar installations (AB 1969)

California adopts green building codes

Land use strategy requirements mandated to reduce GHG emissions (SB 375)

Green Collar Jobs Council established (AB 3018)

California Air Resources Board adopts the AB 32 Scoping Plan to reduce greenhouse gas emissions to 1990 levels by 2020

2009

U.S. Environmental Protection Agency adopts more stringent tailpipe rules modeled after those of California

2011

U.S. Department of Transportation, U.S. Environmental Protection Agency and California Air Resources Board announce a unified timeframe for CAFE and greenhouse gas standards for cars and trucks model year 2017-2025 so that automakers can work towards a single national program

The Obama administration and 13 major automakers agree to raise CAFE standards up from 27 to an average of 54.5 miles per gallon by 2025

The Western Climate Initiative Inc., a nonprofit corporation with officials from Canada and California, is formed to support the implementation of greenhouse gas emissions trading programs

2009

California Air Resources Board adopts regulation to reduce carbon intensity of transportation fuel 10% by 2020

California adopts efficiency standards for 23 categories of appliances including clothes washers and audio visual products

California legislation revises net energy metering to require utilities to reimburse customers for up to 2.5% of the excess demand from power generated from customer's solar and wind power systems (AB 920)

California Energy Commission established regulation to increase building energy efficiency and lower operation costs (AB 758)

The California Energy Commission set the world's most rigorous efficiency standards for televisions, cutting electricity needs for new flat-panel sets by about 50%

California establishes the Clean Vehicle Rebate Project and Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project to provide rebates for zero emission or plug-in hybrid electric vehicles

2010

California Air Resources Board finalizes regulation of Palvey Act for greenhouse gas emissions from passenger vehicles

California raises cap on net metering from 2.5% to 5% (AB 510)

Clean technology manufacturing equipment is exempt from sales tax (SB 71)

2011

California legislation increases the state's RPS to require all retail sellers of electricity and all publicly owned utilities to procure at least 33% of electricity delivered to their retail customers from renewable resources by 2020, the most ambitious standard in the country (SB X1-2)

California legislature passes the Renewable Energy Equity Act (SB 489), which expands the Net Energy Metering Program to all eligible forms of renewable energy allowing small-scale renewable energy producers to participate

Governor Brown announces the Clean Energy Jobs Plan which calls for 12,000 megawatts to come from localized energy sources and 8,000 megawatts of large scale renewable & necessary transmission lines by 2020

California legislation extends the Self-Generation Incentive Program (AB 1150), which helps customers switch to clean energy and provides a bridge for clean energy technologies to scale up and drive down costs

California legislation aims to reduce pollution and waste by more than 15 million tons annually; establishing a new statewide goal of 75% source reduction, recycling and composting by 2020 (AB 341), the highest in the nation

California leads the nation in solar energy installations, with a total of over 1,000 megawatts installed at homes and businesses in the state, nearly a third of total installations in 2011

2012

California Air Resources Board passes the Advanced Clean Car Rules to be attained by 2025, including a mandate for manufacturers to produce 1.4 million zero-emission vehicles, in addition to a 75% reduction in smog-forming pollutants and a 34% reduction in greenhouse gas emissions

Governor Brown reinforces the Air Resources Board's clean car rules by issuing an executive order for 1.5 million zero-emission vehicles and supporting infrastructure to be operating in California by 2025 (B-16-12)

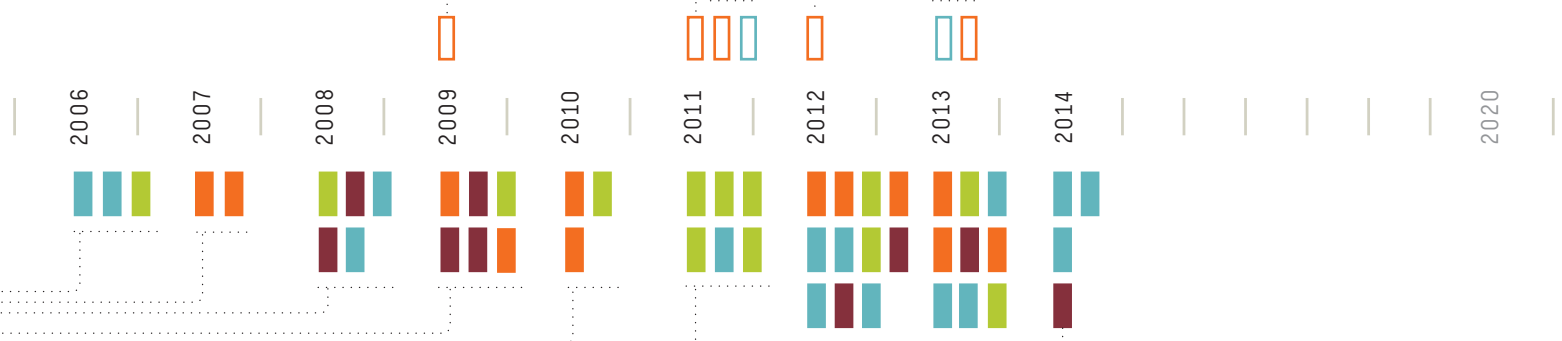
California PUC potentially doubles the amount of solar power utilities will purchase from homeowners and businesses by adjusting how electricity generation is calculated under the net metering program

California Air Resources Board issues final regulations on the Low Carbon Fuel Standard

California established the Greenhouse Gas Reduction Fund as a special fund to collect cap-and-trade auction revenues (SB 1018)

California passes two laws to establish a process for spending revenue generated from the cap-and-trade program, with an emphasis on improving air quality and benefiting disadvantaged communities (AB 1532 and SB 535)

California standardizes and limits the fees city and county governments can charge on building permits for rooftop solar (SB 1222)



2012

U.S. Environmental Protection Agency and the National Highway Traffic Safety Administration issued a final rule that raises average CAFE standards for cars and light-duty trucks to 54.5 miles per gallon by 2025

2013

U.S. Environmental Protection Agency proposes a carbon emissions standard for new fossil fuel-fired electric utility power plants

California joins seven other states in an initiative to put 3.3 million zero-emission vehicles on the road by 2025

Voters pass Prop 39, the Clean Energy Jobs Act, to provide an estimated $500 million annually for five years for energy efficiency and clean energy programs, such as retrofits of schools and government buildings

California Air Resources Board conducts its first quarterly auction for emissions allowances in the cap-and-trade program as authorized by AB 32

California PUC approves nearly $2 billion in energy efficiency program financing over the next two years

California PUC approves a plan to distribute 85% of revenue from the sale of greenhouse gas allowances from the state's three investor owned utilities to households in a semi-annual credit on their energy bill, a type of "climate dividend"

2013

Governor Brown releases the Zero Emission Vehicle Action Plan that identifies specific strategies and actions that state agencies will take to meet milestones of the executive order for 1.5 million zero-emission vehicles in California by 2025

California PUC mandates that the state's three investor owned utilities add a combined 1.3 gigawatts of energy storage by 2020

California signs three national and international agreements to cooperate on reducing greenhouse gases and align policies, with China, Quebec, and the Northwestern states/provinces of Oregon, Washington and British Columbia

California extends to 2024 key auto emissions reductions programs, including the Alternative and Renewable Fuel and Vehicle Technology Program, Air Quality Improvement Program, and the Carl Moyer Program (AB 8)

California PUC adopts the Efficiency Savings and Performance Incentive program for investor owned utilities to earn up to $89 million a year as a reward for helping customers achieve long-term energy savings

California improves access to electric vehicle charging stations through two laws, requiring infrastructure for stations at new multi-family housing and non-residential developments, and simplifying access to stations (AB 1092 and SB 454)

California implements the Safe Consumer Products Regulations, which requires producers to look at safer alternatives for known toxic substances in their products

California creates a voluntary green tariff that allows utility ratepayers who cannot install their own renewable energy generation to purchase energy from shared renewable facilities and receive bill credits (SB 43)

California protects net metering and removes the 33% ceiling on the RPS (AB 327)

2014

California Air Resources Board updates the AB 32 Scoping Plan with key focus areas to reduce greenhouse gas emissions to 1990 levels by 2020

California lawmakers propose a bill to establish greenhouse gas emission targets beyond 2020

California Energy Commission announces it will update energy efficiency standards for 15 appliances over the next two years

California residential and small business customers start seeing a Climate Credit from utilities on their electricity bills, which can be used to help cut their energy use

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NEXT 10

2014 CALIFORNIA
GREEN INNOVATION INDEX

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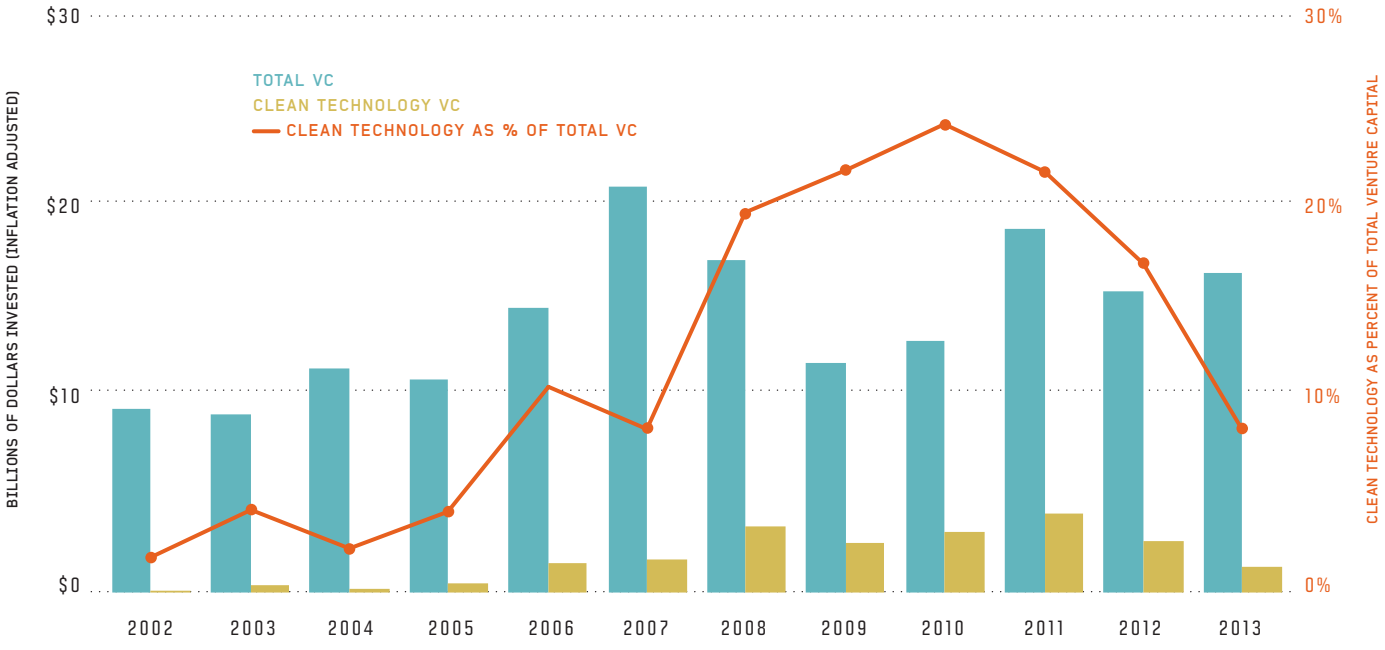
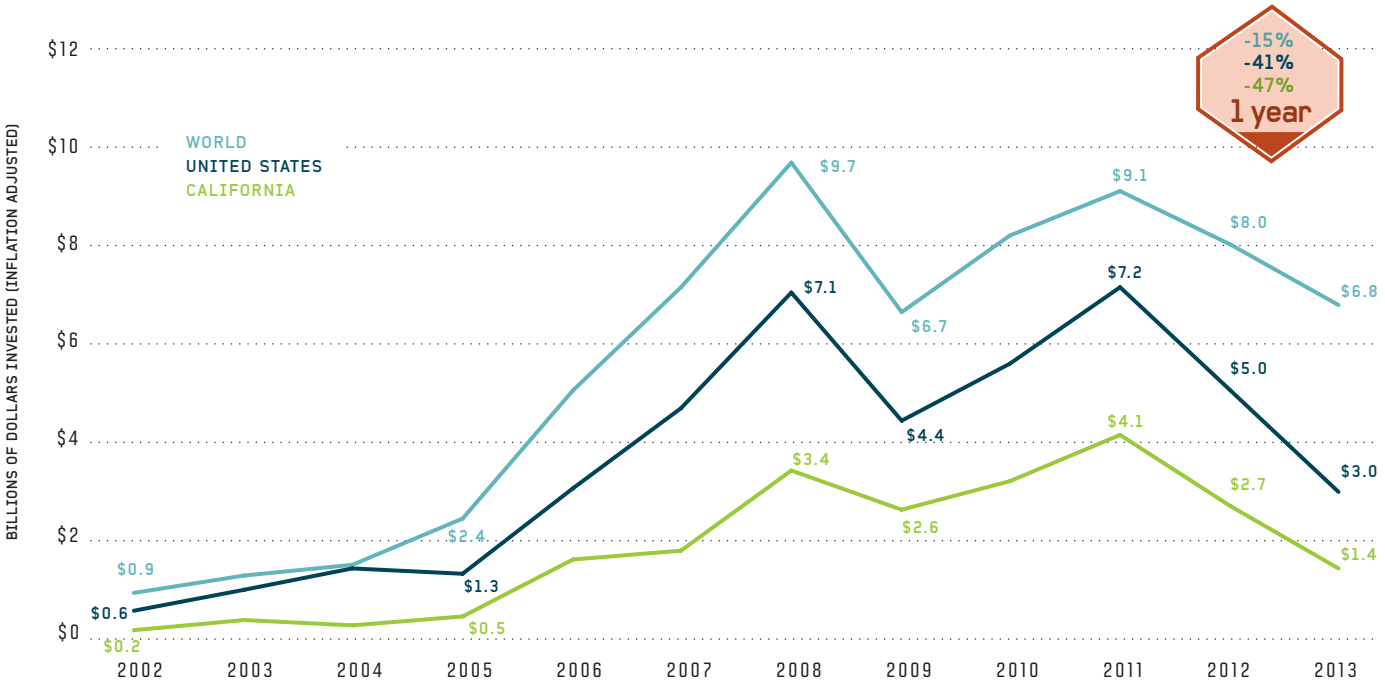
USING VEGETABLE-BASED INKS

FIGURE 24. VENTURE CAPITAL CLEAN TECHNOLOGY VC & TOTAL VC INVESTMENT / CALIFORNIA



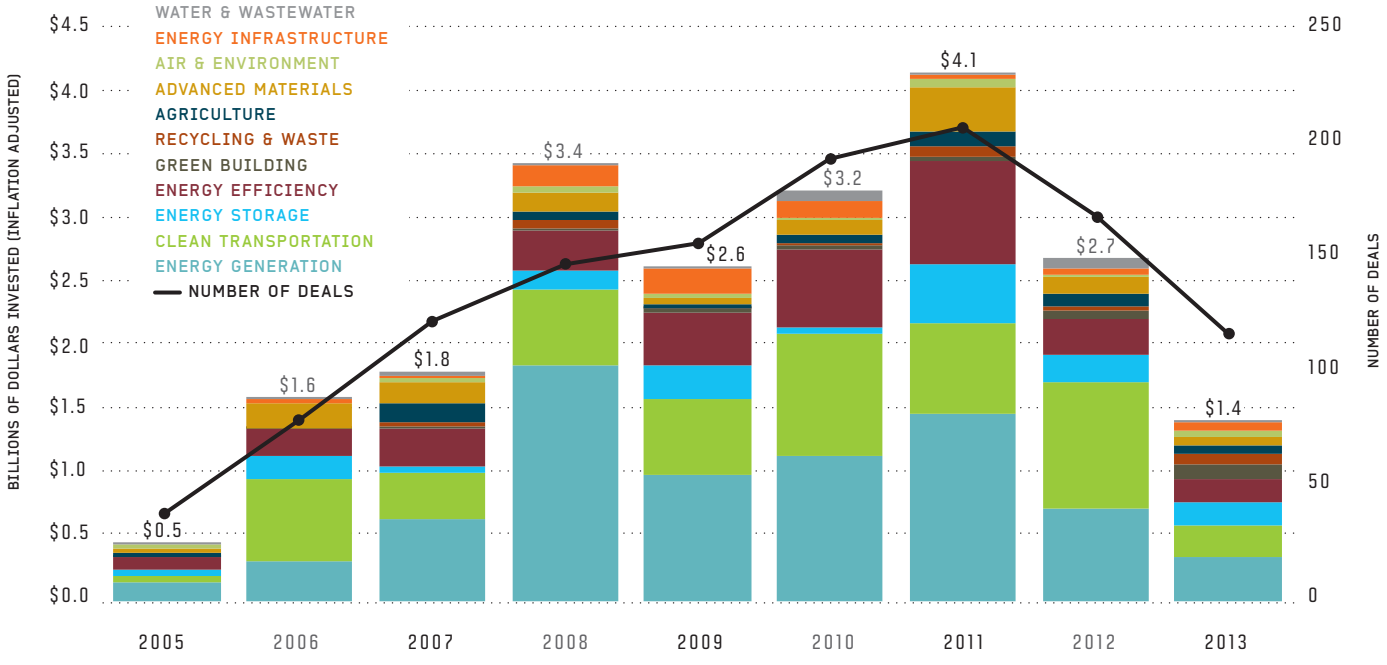
NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: CB Insights. Analysis: Collaborative Economics

FIGURE 25. VENTURE CAPITAL INVESTMENT IN CLEAN TECHNOLOGY CALIFORNIA, THE UNITED STATES & GLOBAL



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: CB Insights and Cleantech Group LLC. Analysis: Collaborative Economics

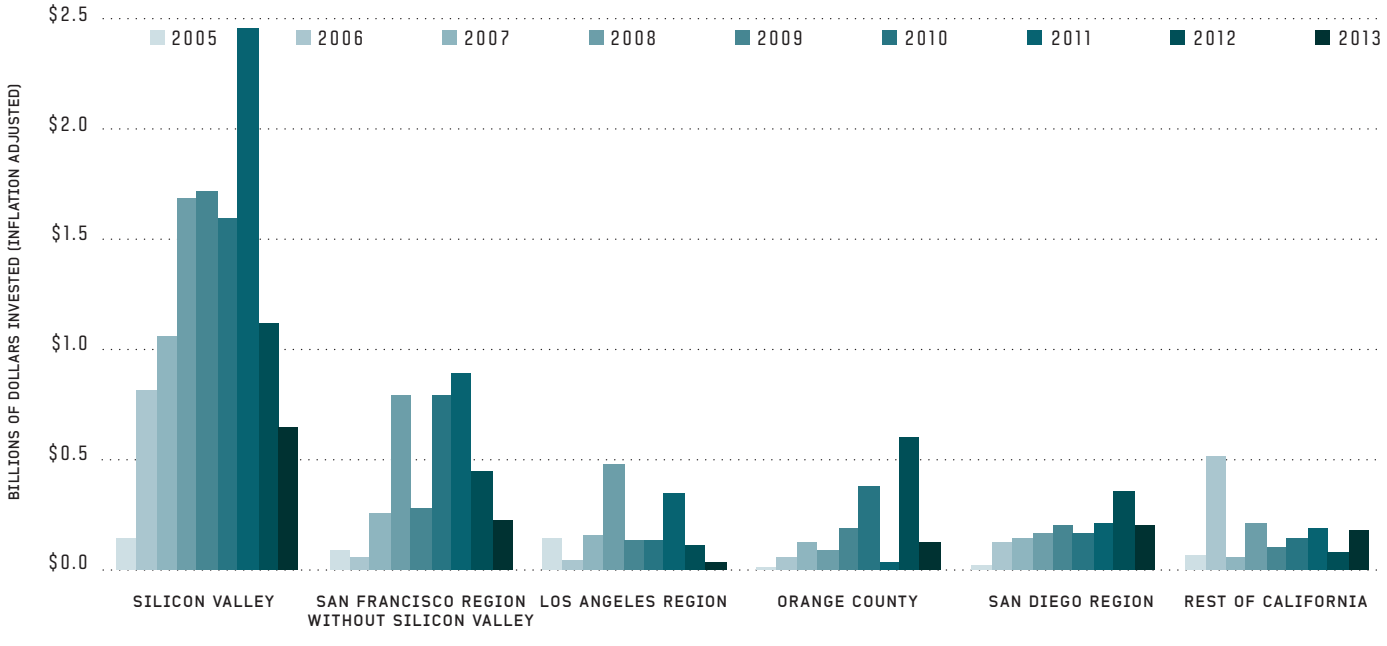
FIGURE 26. VENTURE CAPITAL INVESTMENT IN CLEAN TECHNOLOGY BY SEGMENT CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: CB Insights. Analysis: Collaborative Economics

FIGURE 27. VENTURE CAPITAL INVESTMENT IN CLEAN TECHNOLOGY BY REGION

SILICON VALLEY, SAN FRANCISCO WITHOUT SILICON VALLEY, LOS ANGELES AREA, ORANGE COUNTY, SAN DIEGO REGION & REST OF CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: CB Insights. Analysis: Collaborative Economics

Silicon Valley continues to attract the most clean technology venture capital in California as highlighted in Figure 27, with 46 percent ($650 million) of the state total in 2013. The San Francisco Region (without Silicon Valley), the San Diego Region, and the Rest of California all came in a close second, at 15, 14, and 13 percent of the total respectively. All regions in California experienced a decrease in 2013, except the broader Rest of California region.

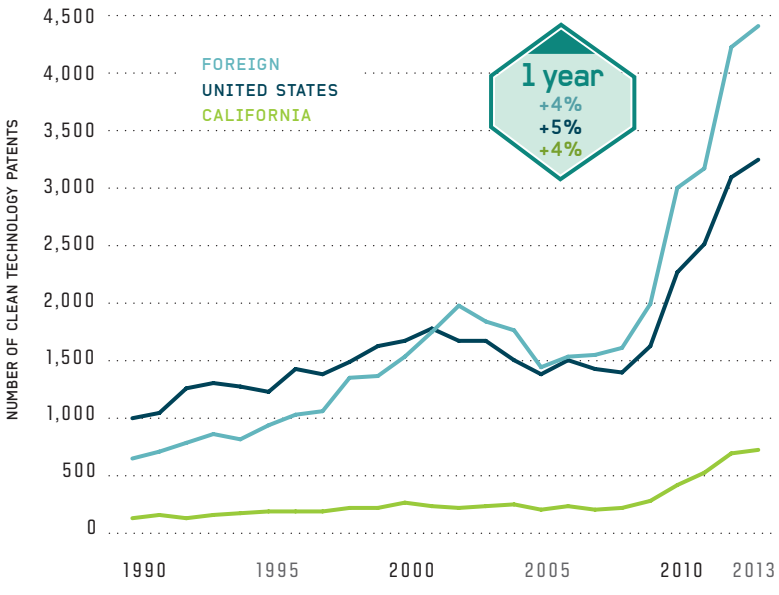
CLEAN TECHNOLOGY PATENTS

California continues to lead the U.S. in clean technology patent innovations overall and in most segments. Patent registrations have been somewhat insulated from the decrease in venture capital in recent years, in part because a substantial portion of patent activity has come from long-established corporations, as well as research institutions, which are not dependent on private venture funding. Large corporations such as General Motors and Boeing accounted for 36 percent of patents in 2012-2013, with academic, research and military institutions registering six percent; the remaining 58 percent derived from emerging companies and individual inventors.

Patent registrations rose by four percent between 2012 and 2013 in California, the same as foreign inventors (+4%) and slightly less than the U.S. overall (+5%) (Figure 28). The recent year experienced a slower pace of growth following a surge of registrations between 2011 and 2012. Taking into account this surge, California outpaced the U.S. overall with a 38 percent increase between 2011 and 2013, while the U.S. overall rose 29 percent and foreign inventors jumped 39 percent. This increasing patent trend in 2012-2013 may be influenced by earlier high venture investments due to an 18-month to three-year average time lag between filing a patent application and issuance of the patent.

California had a total of more than 1,434 clean technology patents in the 2012-2013 period, more than twice as many as the next leading state of Michigan (Table 5). Other states have had notable jumps in national ranking compared to ten years prior, including Massachusetts and Colorado. The strong growth in patents pushed California to account for an even larger share of total U.S. patent registrations in several segments compared to prior years (Figure 29). In the 2012-2013 period, California's share of total U.S. solar patents was down slightly but was still over 40 percent. California

FIGURE 28. CLEAN TECHNOLOGY PATENT REGISTRATIONS
BY LOCATION OF PRIMARY INVENTOR / CALIFORNIA, U.S. & FOREIGN



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

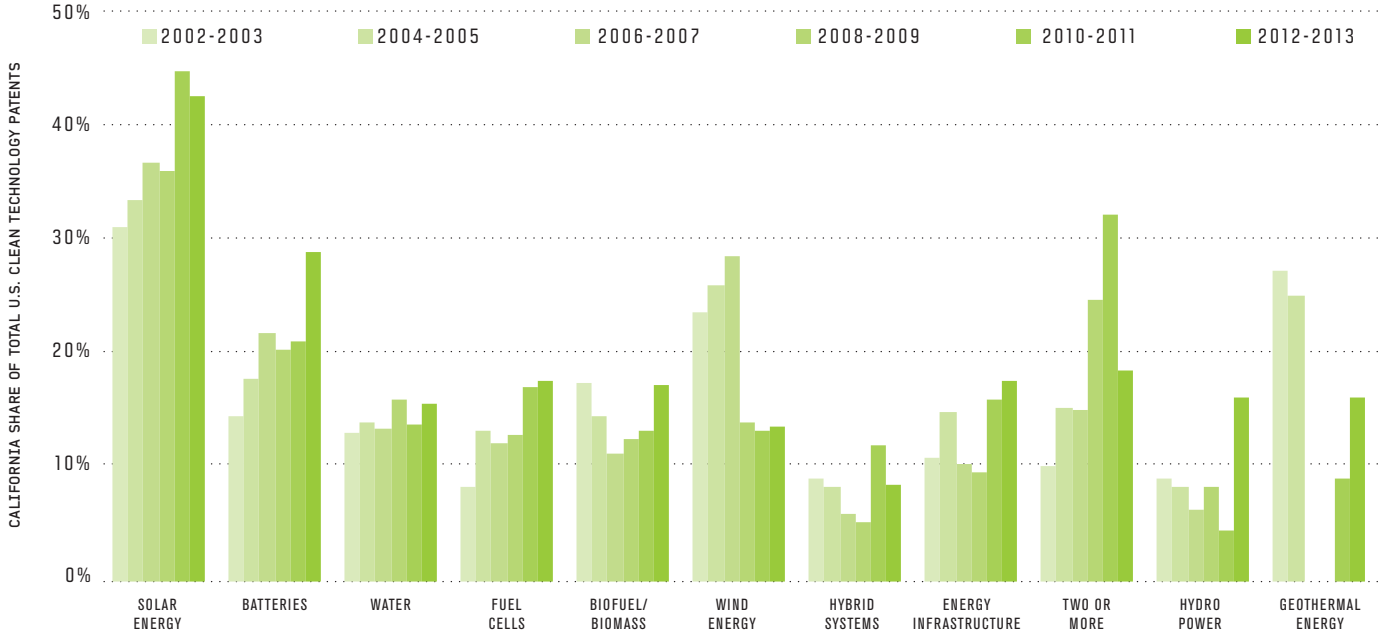
TABLE 5. NATIONAL TOTAL CLEAN TECHNOLOGY PATENT RANKING

CALIFORNIA

	NUMBER OF PATENTS	RANKING	
	2012 - 2013	2002 - 2003	2012 - 2013
CALIFORNIA	1434	1	1
MICHIGAN	663	3	2
NEW YORK	440	2	3
TEXAS	418	4	4
MASSACHUSETTS	271	10	5
FLORIDA	232	7	6
ILLINOIS	224	5	7
PENNSYLVANIA	197	9	8
COLORADO	193	16	9
OHIO	177	6	10

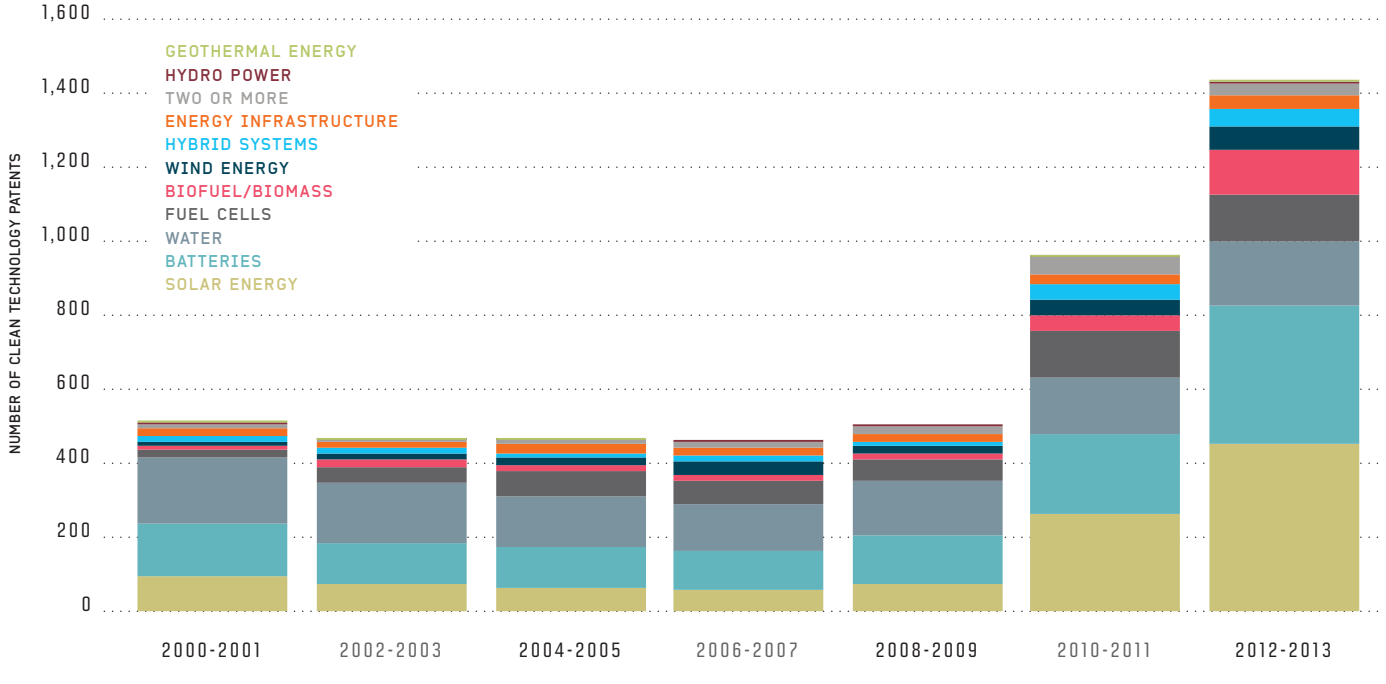
NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

FIGURE 29. CLEAN TECHNOLOGY PATENTS CALIFORNIA SHARE OF TOTAL U.S. CLEAN TECHNOLOGY PATENTS



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

FIGURE 30. CLEAN TECHNOLOGY PATENTS BY TECHNOLOGY TYPE / CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

increased its share of battery technology patents to 29 percent of the total U.S. registrations and biofuel/biomass patents to 17 percent, while the share of hybrid systems patents dropped slightly.

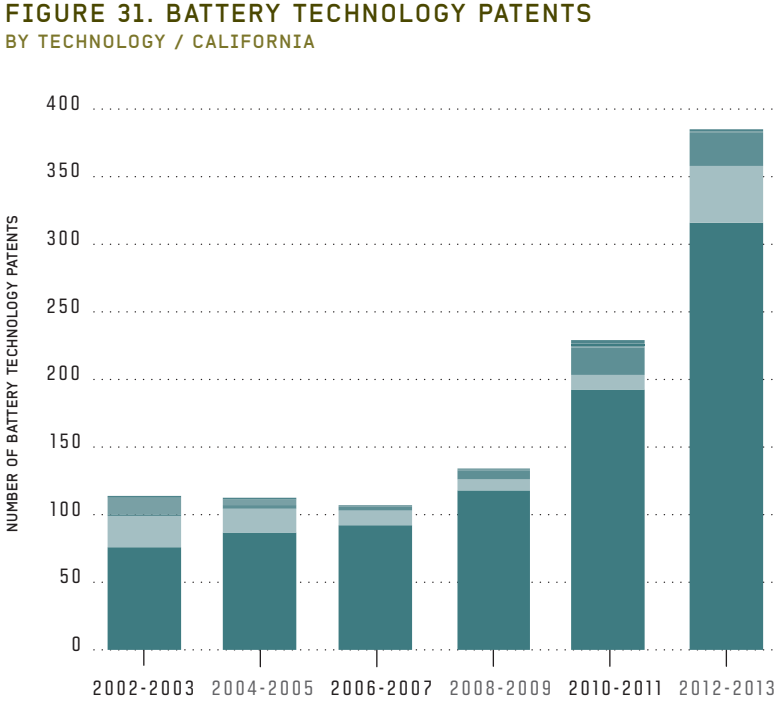
Overall, California registered 50 percent more clean technology patents in 2012-2013 compared to 2010-2011. Most of California's clean technology patent activity was in solar energy, batteries, water, fuel cells, and biofuel/biomass as demonstrated in Figure 30. These segments comprised over 87 percent of California's total clean technology patents in the 2012-2013 period. All of the segments grew in 2012-2013 compared to 2010-2011, with the exception of a slight decline of one percent in fuel cell technology.

California's battery patent registrations grew by a robust 67 percent between the 2010-2011 and 2012-2013 periods (Figure 31). Other advanced storage technology continued to be the largest sub-segment, which included storage innovations outside of the most prevalent chemical battery categories, though lithium batteries had the highest growth rate with a nearly four-fold increase. Battery technology patents were the largest segment in U.S. overall patent activity in 2012-2013, and California helped lead that growth. California had the most battery patents among states and had more than twice the patents as Michigan, the next highest ranked state (Table 6) (see the Energy Storage feature on page 46 for more information).

Water technology patents were the third largest segment of clean technology patent activity in California in the 2012-2013 period and increased ten percent compared to 2010-2011 (Figure 32). Water technology sub-segments had mixed growth in the latest time period; water conservation patents more than doubled and mechanical filtration and treatment patents increased 46 percent, while desalination patents dipped 26 percent and wave energy filtration and treatment declined 11 percent compared to 2010-2011. Water technology patent levels in 2012-2013 returned to the recorded high in 2000-2001.

FIGURE 31. BATTERY TECHNOLOGY PATENTS

BY TECHNOLOGY / CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

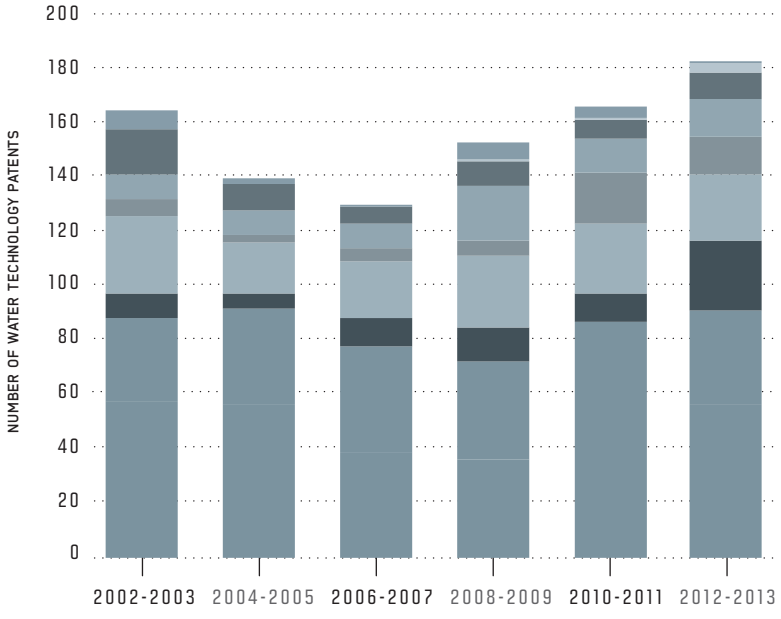
TABLE 6. BATTERY TECHNOLOGY

TOP RANKING STATES IN PATENTS REGISTERED

	NUMBER OF PATENTS	RANKING	
	2012 - 2013	2002 - 2003	2012 - 2013
CALIFORNIA	385	1	1
MICHIGAN	178	3	2
TEXAS	67	7	3
MASSACHUSETTS	65	6	4
NEW YORK	61	2	5
ILLINOIS	60	8	6
OHIO	54	5	7
MINNESOTA	45	13	8
COLORADO	40	17	9
WISCONSIN	36	11	10

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

FIGURE 32. WATER TECHNOLOGY PATENTS
BY TECHNOLOGY / CALIFORNIA



- WATER FILTRATION/TREATMENT - BIOLOGICAL
- WATER FILTRATION/TREATMENT - ELECTROCHEMICAL
- WATER FILTRATION/TREATMENT - CHEMICAL
- WATER FILTRATION/TREATMENT - ALL OTHER
- DESALINATION
- WASTEWATER/STORMWATER TREATMENT
- WATER CONSERVATION
- WATER FILTRATION/TREATMENT - MECHANICAL (FILTER, MEMBRANE, ETC.)
- WATER FILTRATION/TREATMENT - WAVE ENERGY

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

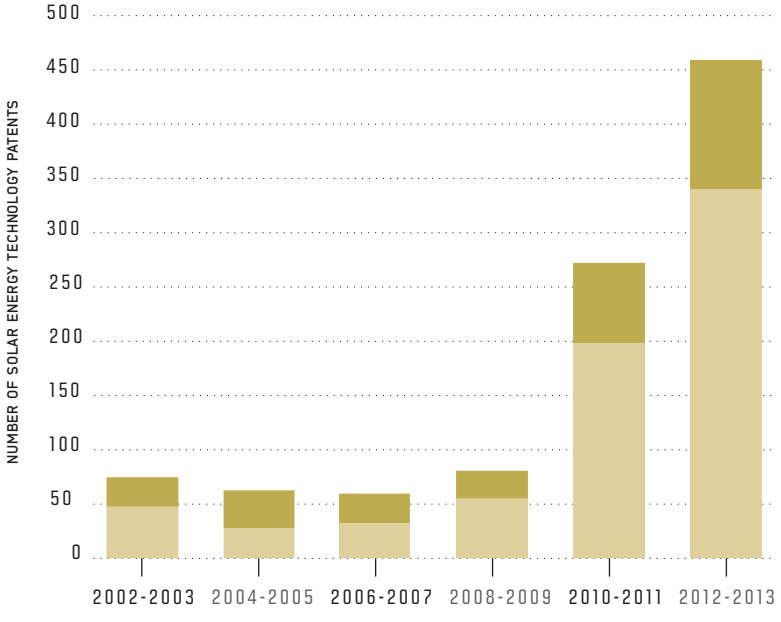
TABLE 7. WATER TECHNOLOGY

TOP RANKING STATES IN PATENTS REGISTERED

	NUMBER OF PATENTS	RANKING	
	2012 - 2013	2002 - 2003	2012 - 2013
CALIFORNIA	183	1	1
TEXAS	104	2	2
FLORIDA	76	3	3
PENNSYLVANIA	63	7	4
MICHIGAN	49	12	5
ILLINOIS	47	5	6
NEW YORK	44	4	7
MASSACHUSETTS	40	11	8
OHIO	39	8	9
MINNESOTA	39	6	9

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

FIGURE 33. SOLAR ENERGY TECHNOLOGY PATENTS
BY TECHNOLOGY / CALIFORNIA



- OTHER SOLAR
- PHOTOVOLTAIC

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

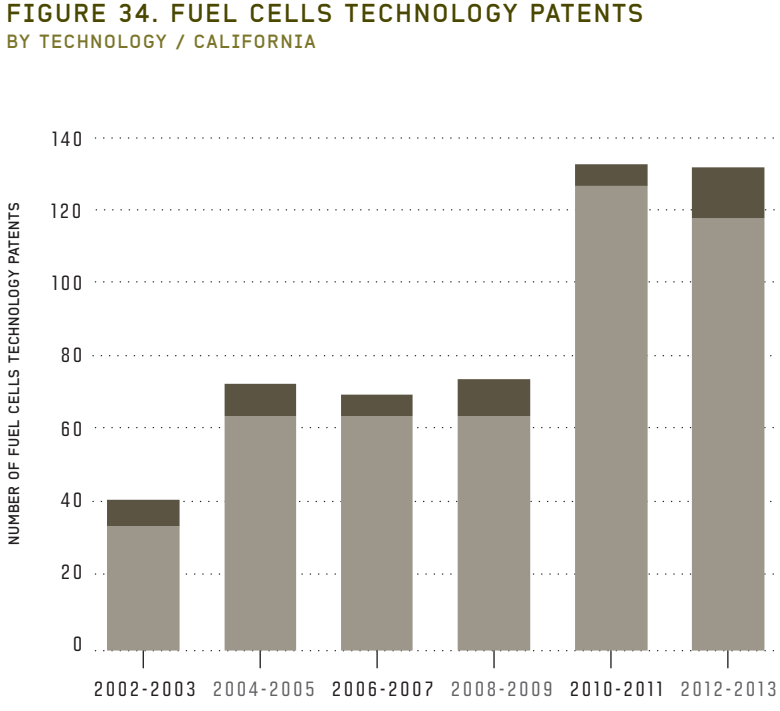
TABLE 8. SOLAR ENERGY TECHNOLOGY

TOP RANKING STATES IN PATENTS REGISTERED

	NUMBER OF PATENTS	RANKING	
	2012 - 2013	2002 - 2003	2012 - 2013
CALIFORNIA	459	1	1
NEW YORK	63	3	2
MASSACHUSETTS	59	6	3
COLORADO	58	5	4
TEXAS	46	2	5
PENNSYLVANIA	44	10	6
MICHIGAN	44	6	6
NEW JERSEY	39	3	8
FLORIDA	39	11	8
NEW MEXICO	28	17	10

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

FIGURE 34. FUEL CELLS TECHNOLOGY PATENTS
BY TECHNOLOGY / CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

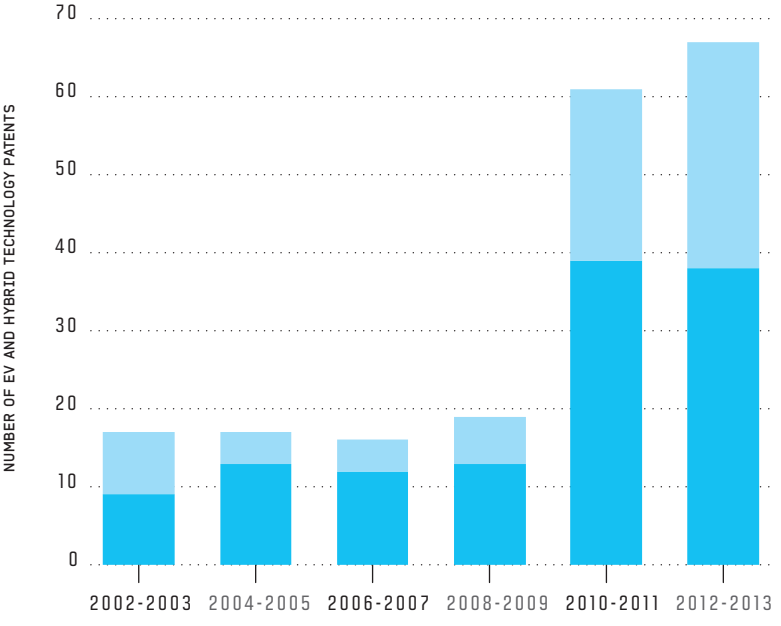
TABLE 9. FUEL CELLS TECHNOLOGY

TOP RANKING STATES IN PATENTS REGISTERED

	NUMBER OF PATENTS	RANKING	
	2012 - 2013	2002 - 2003	2012 - 2013
NEW YORK	198	1	1
CALIFORNIA	132	3	2
MICHIGAN	63	4	3
CONNECTICUT	62	2	4
MASSACHUSETTS	39	6	5
MINNESOTA	36	12	6
PENNSYLVANIA	23	7	7
OHIO	21	5	8
TEXAS	18	8	9
OREGON	17	15	10

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

FIGURE 35. HYBRID & ELECTRIC SYSTEMS TECHNOLOGY PATENTS BY TECHNOLOGY / CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

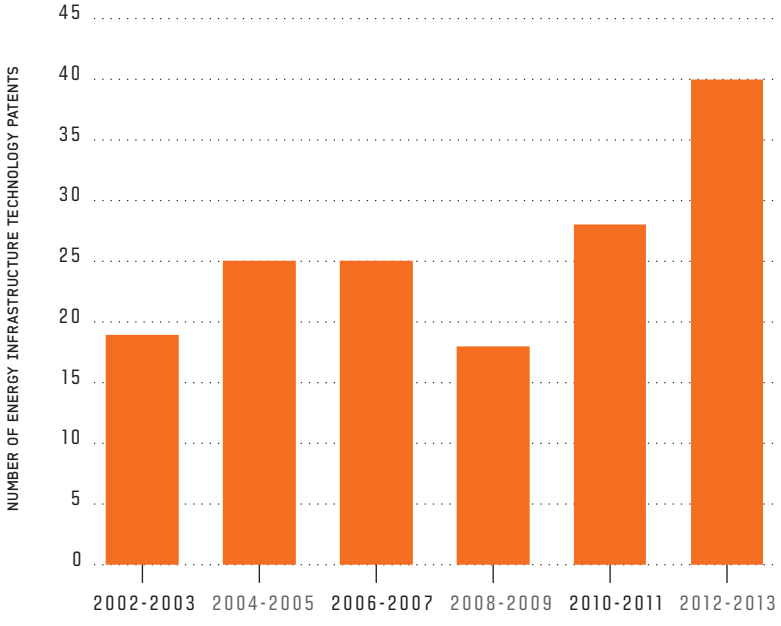
TABLE 10. HYBRID SYSTEMS TECHNOLOGY

TOP RANKING STATES IN PATENTS REGISTERED

	NUMBER OF PATENTS	RANKING	
	2012 - 2013	2002 - 2003	2012 - 2013
MICHIGAN	319	1	1
CALIFORNIA	67	2	2
INDIANA	33	3	3
ILLINOIS	27	14	4
FLORIDA	23	9	5
OHIO	19	7	6
NEW YORK	15	4	7
OREGON	11	34	8
COLORADO	11	9	8
WASHINGTON	10	28	10

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

FIGURE 36. ENERGY INFRASTRUCTURE TECHNOLOGY PATENTS BY TECHNOLOGY / CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

ENERGY INFRASTRUCTURE

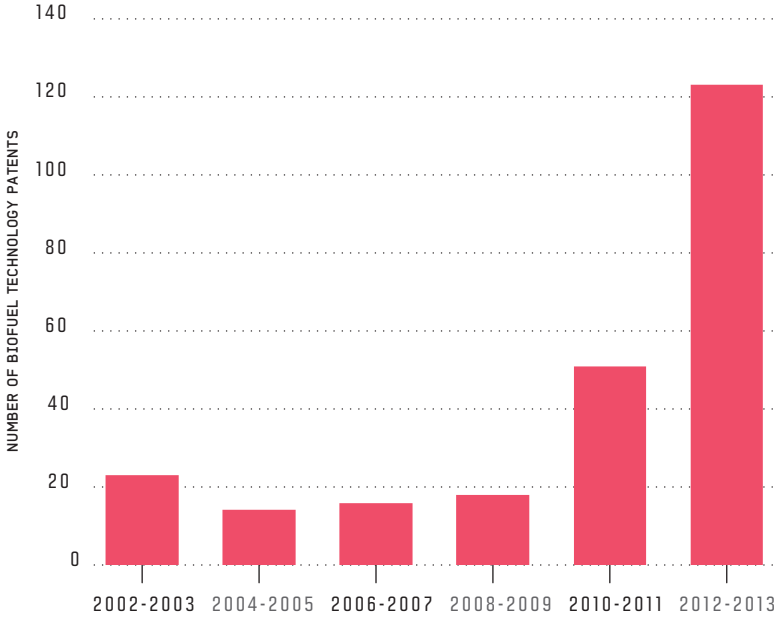
TABLE 11. ENERGY INFRASTRUCTURE TECHNOLOGY

TOP RANKING STATES IN PATENTS REGISTERED

	NUMBER OF PATENTS	RANKING	
	2012 - 2013	2002 - 2003	2012 - 2013
CALIFORNIA	40	2	1
WASHINGTON	30	13	2
TEXAS	15	8	3
NEW YORK	15	1	3
FLORIDA	15	17	3
NORTH CAROLINA	10	3	6
MINNESOTA	9	25	7
WISCONSIN	8	5	8
NEW JERSEY	8	14	8
GEORGIA	7	9	10

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

FIGURE 37. BIOFUEL/BIOMASS TECHNOLOGY PATENTS BY TECHNOLOGY / CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File. Analysis: Collaborative Economics

BIOFUEL/BIOMASS

TABLE 12. BIOFUEL/BIOMASS TECHNOLOGY

TOP RANKING STATES IN PATENTS REGISTERED

	NUMBER OF PATENTS	RANKING	
	2012 - 2013	2002 - 2003	2012 - 2013
TEXAS	128	1	1
CALIFORNIA	123	2	2
ILLINOIS	51	4	3
ARIZONA	43	25	4
MASSACHUSETTS	33	47	5
COLORADO	32	6	6
WISCONSIN	21	29	7
FLORIDA	21	49	7
NEW YORK	20	7	9
MICHIGAN	19	18	10

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California's solar patents continued to grow rapidly in 2012-2013, with a 68 percent increase from the 2010-2011 period (Figure 33). Photovoltaic patents rose 72 percent in the latest period, while other solar patents increased 57 percent. The state remains the undisputed leader in solar patents within the U.S.; the next nine highest states' solar patents combined do not reach the level of California's total solar patents in the 2012-2013 period (Table 8).

Fuel cell patent registrations slowed slightly in 2012-2013, with a one percent decrease compared to 2010-2011, though the fuel cell vehicles sub-segment increased (Figure 34). While falling behind New York as the domestic leader in fuel cells in 2012-2013, California maintained a lead over Michigan (Table 9).

California hybrid systems patents increased ten percent in 2012-2013 compared to 2010-2011 (Figure 35); however the state is ranked second, with 21 percent of first ranked Michigan's registrations in this segment (Table 10).

California energy infrastructure patents jumped 43 percent in 2012-2013 over 2010-2011, though this segment had a relatively low concentration of patenting activity among leading states compared to other segments (Figure 36). At 40 patents in 2012-2013, California remains the domestic leader in this segment (Table 11).

Biofuel/biomass patents in California jumped recently, with 2.4 times more registrations in 2012-2013 compared to 2010-2011 (Figure 37.). Texas maintained a narrow lead on California as the top ranking state, with five more biofuel/biomass patents than California in 2012-2013, while California had more than twice as many patents as the next leading state of Illinois (Table 12).

EMPLOYMENT IN THE CORE CLEAN ECONOMY

Employment in California's Core Clean Economy jumped 20 percent over the past ten years to reach nearly 196,000 jobs in January 2012, while jobs in the total state economy grew two percent over the same time period (Figure 38). More recently, employment in the Clean Economy continued its steady growth between January 2011 and January 2012 (the most recent observable period), while California's economy rebounded from the recent economic downturn, and jobs experienced a slightly higher growth rate. During this period, Core Clean Economy jobs increased at a rate of 1.1 percent while total statewide employment expanded by 2.4 percent. In comparison with other sectors in the broader economy, Healthcare jobs increased 2.3 percent in the recent year, though only two percent in the last decade, and Construction & Extraction jobs decreased 3.1 percent between 2011 and 2012 and increased 11 percent in the last decade. Manufacturing sector jobs in the total economy rose 1.9 percent in the recent year, while clean manufacturing jobs specifically grew at a faster pace of 3.2 percent. Clean manufacturing jobs grew dramatically over the last decade, up 53 percent, while total economy manufacturing fell by 21 percent.

The Core Clean Economy is categorized into 15 diverse segments.[21] Nine of these segments increased employment between January 2011 and January 2012, and eleven increased in the last decade (Figure 39). Clean Transportation grew the most in the last decade, with more than twice as many jobs (to 8,500), while Energy Generation (+61% to 42,800), Green Building (+36% to 10,300), and Energy Efficiency (+15% to 17,800) also expanded noticeably. Water & Wastewater and Energy Storage declined in the long term, but both have started to recover in recent years. Energy Storage had one of the largest jumps in the January 2011 to January 2012 period, up 8.1 percent (to 2,700), while Energy Infrastructure had one of the biggest drops of four percent (to 20,400) (Figure 40).

Jobs in the Core Clean Economy can also be categorized by primary function or daily activity along the production value chain. From the point of conception until delivery to the customer, and maintenance over the lifetime of the product, there are many distinct activities that take place in the economy. As of January 2012, Services comprised the majority (57%) of the value chain jobs across California's Core Clean Economy, followed by Manufacturing (13%), Installation (11%), Supplier (10%) and Research & Development (7%), with Sales, Public Education, and Finance/Investment making up the remainder.

California's diverse regions reflect different strengths within the Core Clean Economy, based on unique regional assets, private sector engagement and constructive public policy (Figure 41). In the last decade, only two regions saw

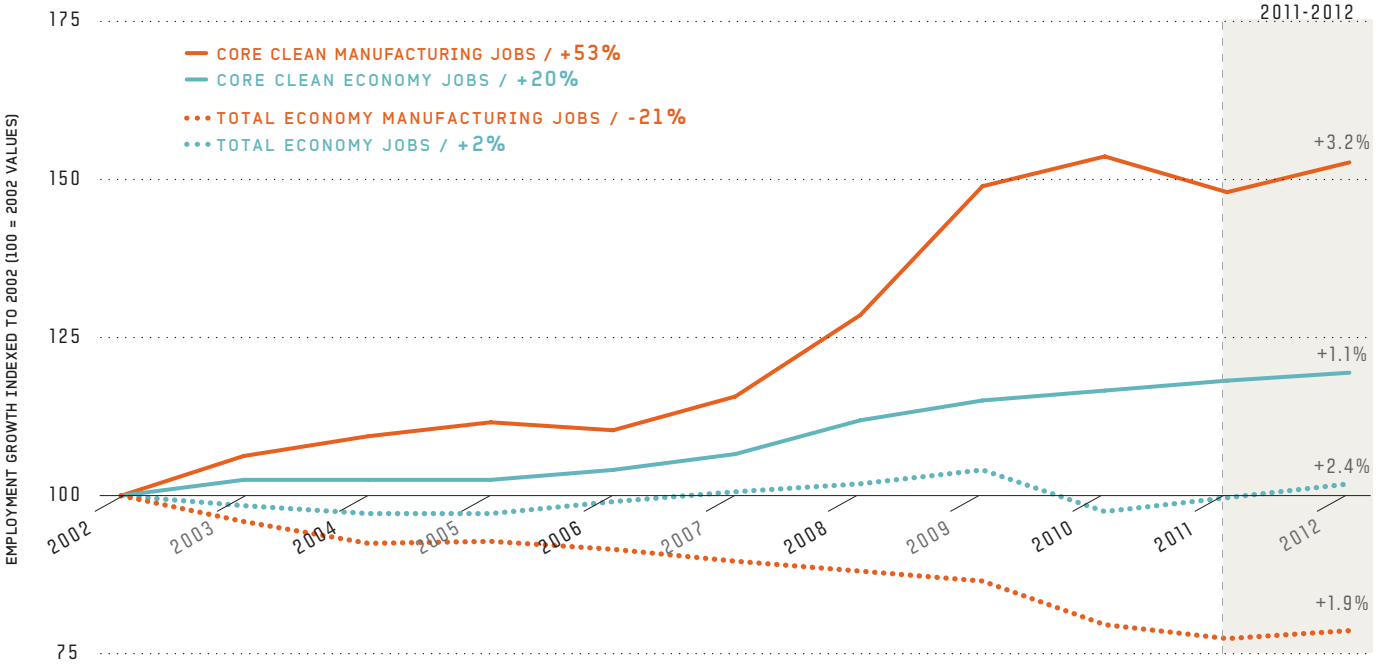
WHY IS IT IMPORTANT?

California's clean economy is growing and creating new jobs and business opportunities across a diverse set of sectors, ranging from water efficiency and recycling to energy and battery technologies. The growing clean economy encompasses both the emergence of new industries and the transformation of existing industries. At the center of these new developments is the **"Core Clean Economy,"** which includes businesses that provide the cutting-edge products and services that allow the entire economy to transition away from fossil fuels and use natural resources more efficiently. The **"Adaptive Clean Economy"** represents the growing demand for and application of the Core Clean Economy's innovative products and services in other industries, such as a hotel chain implementing high efficiency light bulbs and water systems. While the Adaptive Clean Economy is key to transforming the total economy and the jobs are more numerous than the Core Clean Economy, the jobs associated with this area are not included in this jobs analysis because there is not yet a reliable method of tracking these jobs.

employment decline: the North Coast and Sierra Region. Over the same period, the Inland Empire experienced the fastest growth (+57%), followed by the Sacramento Area (+37%). The Bay Area (including Silicon Valley) accounted for the largest share of clean economy jobs (31%) as of January 2012, along with the highest concentration of jobs in segments such as Energy Generation, Research & Advocacy, and Advanced Materials. Los Angeles had the second highest number of jobs (21%) in the state, and the highest concentration in segments including Air & Environment, Energy Storage, and Recycling & Waste. The San Diego Region had 14 percent of clean economy jobs, and the second largest concentration of jobs in the Clean Transportation and Energy Infrastructure segments. The San Joaquin Valley had the most jobs in the Agricultural Support segment.

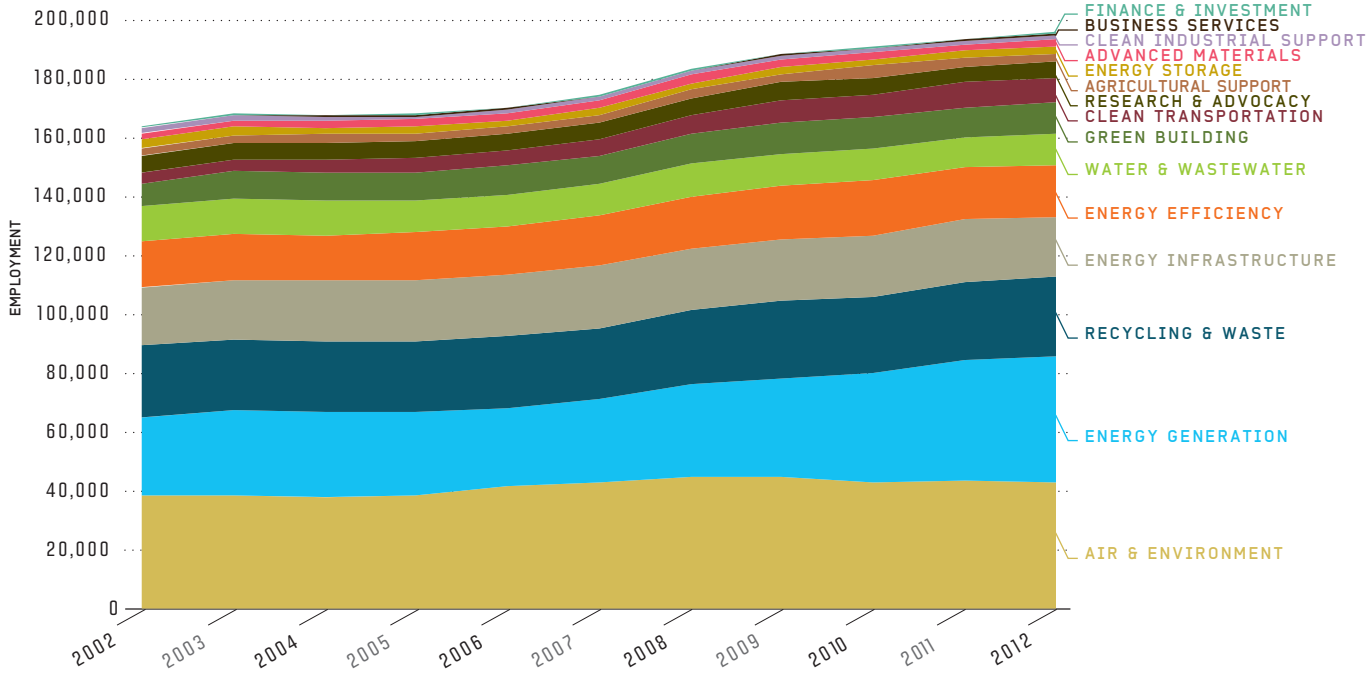
In the most recent year (January 2011 to January 2012), seven of the eleven regions increased employment, and many regions demonstrated much stronger growth than the state as a whole (Table 13). The Sacramento Area experienced the largest overall increase in clean economy jobs (+5%), with the most growth occurring in the Air & Environment segment (+12%). The Los Angeles Area had the second highest growth rate overall (+4%), led by growth in Energy Storage, Energy Generation, and Water & Wastewater. Orange County had the third highest overall expansion (+2%), with a large jump in Clean Transportation (+28%). Clean economy employment in the Central Coast, the Sierra Region, the Sacramento Valley, and the San Joaquin Valley declined overall, but each region also saw employment increase in multiple segments.

FIGURE 38. EMPLOYMENT GROWTH RELATIVE TO 2002 CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: Green Establishments Database. Analysis: Collaborative Economics

FIGURE 39. EMPLOYMENT BY CLEAN ECONOMY SEGMENT CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX Data Source: Green Establishments Database. Analysis: Collaborative Economics

FIGURE 40. CORE CLEAN ECONOMY SEGMENT GROWTH RELATIVE TO 2002 CALIFORNIA

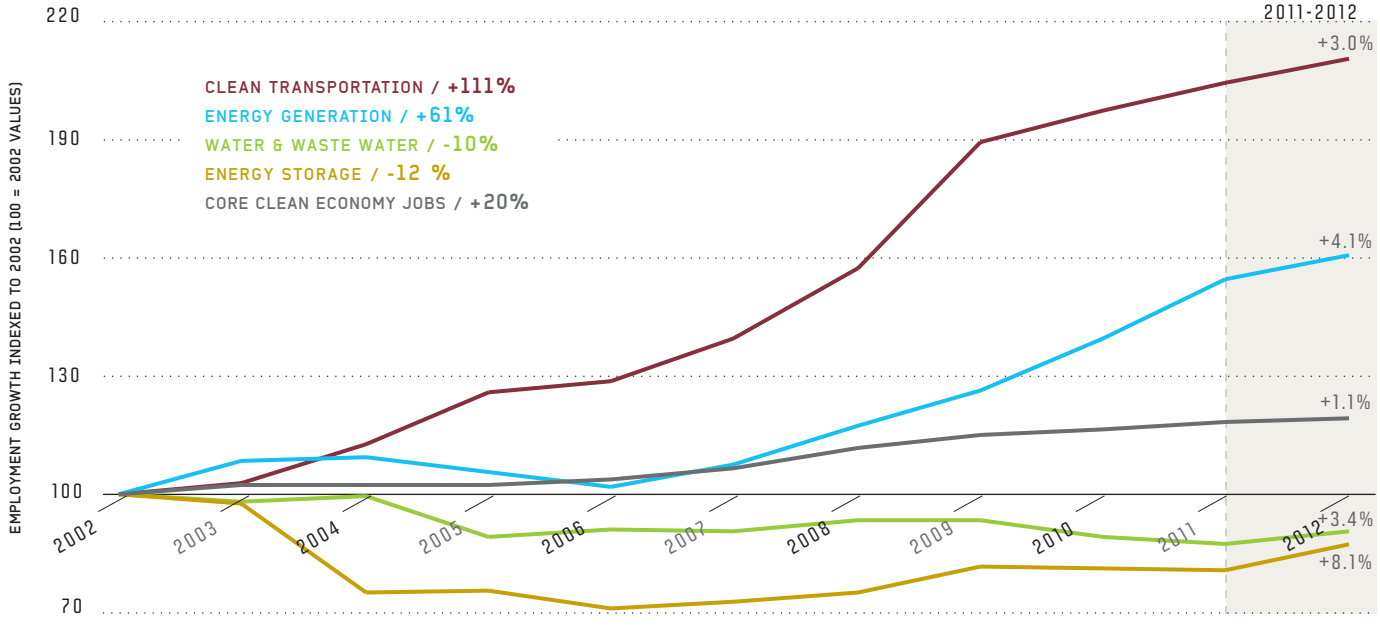


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FIGURE 41. REGIONAL EMPLOYMENT BY CLEAN ECONOMY SEGMENT CALIFORNIA 2012

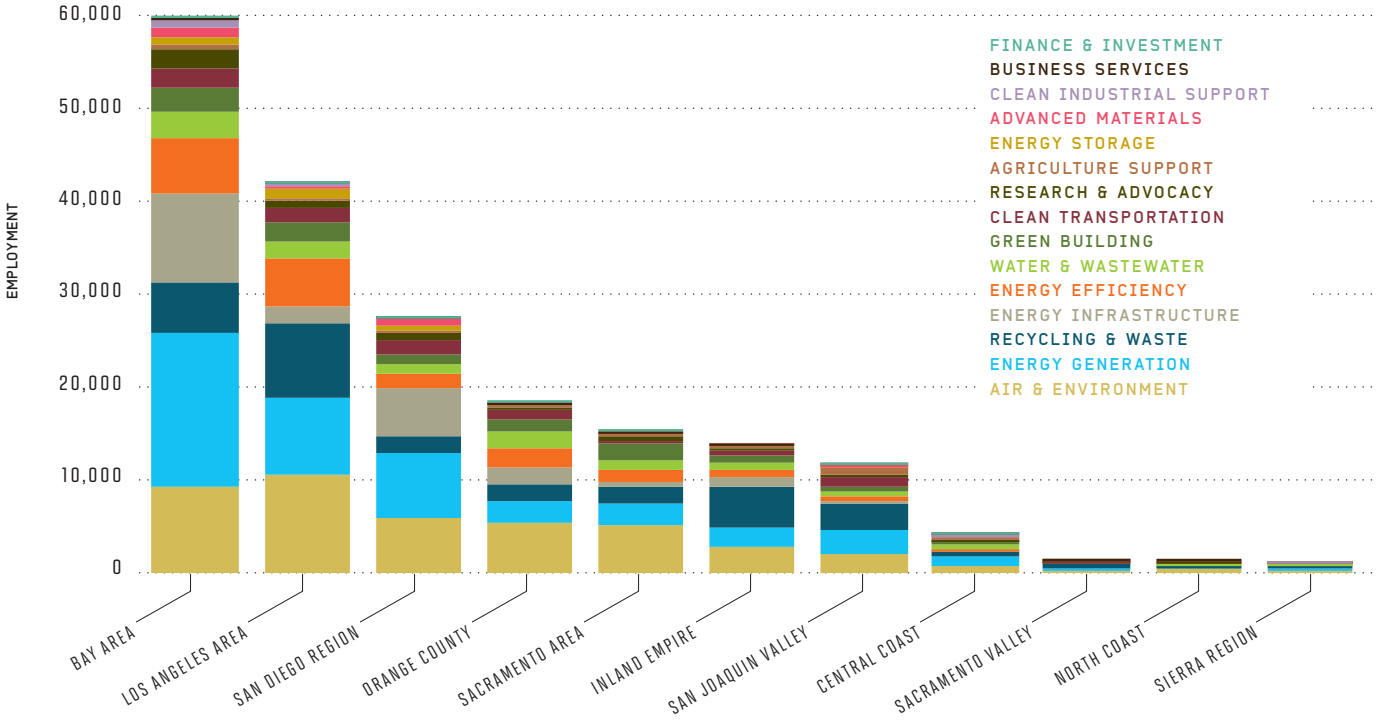

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TABLE 13. REGIONAL EMPLOYMENT CHANGE BY CLEAN ECONOMY SEGMENT

PERCENT CHANGE IN EMPLOYMENT FROM JANUARY 2011 TO JANUARY 2012

	CALIFORNIA	SACRAMENTO AREA	LOS ANGELES AREA	ORANGE COUNTY	INLAND EMPIRE	BAY AREA	NORTH COAST	SAN DIEGO REGION	CENTRAL COAST	SIERRA REGION	SACRAMENTO VALLEY	SAN JOAQUIN VALLEY
Clean Industrial Support	14%	X	0%	0%	X	11%	X	111%	0%	0%	X	X
Energy Storage	8%	-5%	19%	0%	5%	-0.1%	X	1%	X	X	X	0%
Advanced Materials	8%	0%	3%	0%	0%	-16%	X	84%	0%	X	X	31%
Energy Generation	4%	-4%	18%	16%	-1%	1%	-11%	4%	4%	-6%	-6%	-7%
Water & Wastewater	3%	-1%	15%	-0.4%	4%	3%	0%	-0.08%	-7%	-1%	15%	3%
Clean Transportation	3%	-0.4%	1%	28%	-0.4%	0.05%	0%	-1%	-8%	67%	-11%	2%
Energy Efficiency	3%	3%	2%	-1%	-1%	5%	3%	3%	11%	-10%	-5%	1%
Recycling & Waste	2%	0.2%	2%	4%	1%	-2%	26%	10%	-3%	-1%	-1%	2%
Green Building	0.5%	7%	-1%	-1%	-2%	1%	-9%	-6%	0%	0%	27%	-2%
Business Services	-0.17%	0%	4%	25%	-31%	-0.3%	0%	0%	0%	X	0%	-50%
Agricultural Support	-0.77%	2%	2%	-18%	2%	15%	2%	2%	2%	0%	-16%	-6%
Air & Environment	-1%	12%	-3%	-4%	-1%	1%	-2%	8%	-5%	-1%	-9%	-32%
Research & Advocacy	-2%	1%	-2%	-1%	-0.4%	-3%	2%	5%	3%	-12%	-17%	-15%
Energy Infrastructure	-4%	3%	1%	-0.2%	28%	-0.3%	X	-18%	-9%	0%	0%	7%
Finance & Investment	-12%	0%	-6%	-2%	X	-20%	X	21%	0%	X	X	0%
Total Core Clean Economy	1%	5%	4%	2%	2%	1%	0.6%	0.4%	-1%	-3%	-6%	-9%

GREEN EMPLOYMENT DECREASED < -10%

GREEN EMPLOYMENT DECREASED BY 0-10%

GREEN EMPLOYMENT STAYED THE SAME

PERCENT CHANGE COULD NOT BE CALCULATED BECAUSE GREEN EMPLOYMENT IN 2011 WAS 0

GREEN EMPLOYMENT INCREASED BY 0-10%

GREEN EMPLOYMENT INCREASED > 10%

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REGIONAL INDICATORS SPOTLIGHT

SAN FRANCISCO BAY AREA

- Leading region for jobs in the clean economy (nearly 60,000 or 31% of state total) and highest concentration in segments such as Energy Generation.
- Highest concentration of the state's ZEV registrations (28% or about 9,500) and the biggest jump (+50%) in electric vehicles between 2011 and 2012.
- Top region for clean technology patent registrations, with 59 percent of the state's total (846) in 2012-2013. Top region in most clean technology patent segments, including batteries, biofuel/biomass, and solar energy.
- Largest total distributed solar installations through CSI, with about 366 MW installed from 2007 to 2013.

SAN DIEGO REGION

- Fastest growth in Advanced Materials jobs between January 2011 and 2012 (+84%).
- Third highest concentration of jobs in the clean economy (about 27,000 or 14% of the state total) and second highest concentration of Clean Transportation jobs.
- High concentration of ZEVs with over 3,600 registrations in 2012, up 52 percent from 2011.
- Second fastest growth in distributed solar installations through CSI between 2012 and 2013 (+11%), and a total of about 137 MW installed between 2007 and 2013.

INLAND EMPIRE

- Fastest growing region in employment in clean economy in the last decade (+57% to 13,700) and the fastest growth in Energy Infrastructure (+28%) between January 2011 and 2012.
- Highest growth in distributed solar installations through CSI between 2012 and 2013 (+19%), with a total of about 193 MW from 2007 to 2013.
- High growth in ZEV registrations, up 32 percent between 2011 and 2012 to 2,500.

LOS ANGELES AREA

- Most jobs in Air & Environment, Energy Storage, and Recycling & Waste segments, and second in total clean economy jobs (about 42,000 or 21% of state total). Second highest growth rate between January 2011 and 2012 (+4%).
- Close second in concentration of the state's ZEVs (27% or about 9,400), up 87 percent between 2011 and 2012.
- Top region in hybrid systems and wind patents in 2012-2013, and the second highest overall in the state for clean technology patents (242). The region would rank sixth in the nation for patent registrations if it was a state.

ORANGE COUNTY AREA

- Large increase in the Clean Transportation segment between January 2011 and 2012 (+28%), and third highest overall expansion in the same time (+2%) to more than 18,000 jobs.
- Fastest growth in plug-in hybrid vehicles, with nearly 13 times more registrations in 2012 than 2011. ZEVs increased 93 percent over the same time to reach a total of about 3,800 ZEVs in 2012.

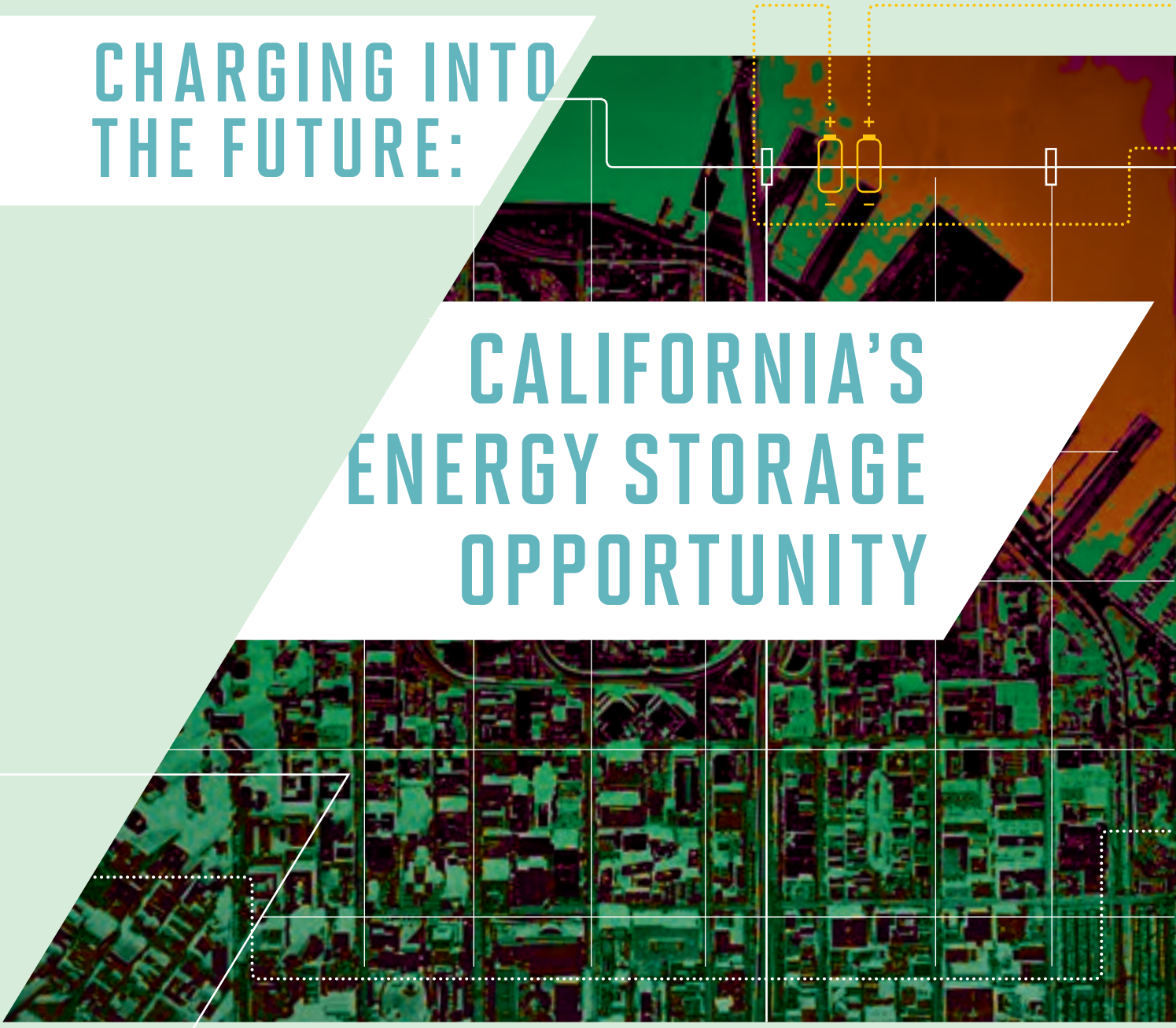
SAN JOAQUIN VALLEY

- Most jobs in Agricultural Support segment (30%), and about 11,500 jobs overall in the clean economy.
- Second in total distributed solar installations through CSI, with nearly 240 MW installed from 2007 to 2013.
- High growth in ZEV registrations, up 30 percent between 2011 and 2012 to 1,300.

SACRAMENTO AREA

- Fastest growing region between January 2011 to 2012 (+5%) and second fastest growing region in employment in clean economy in the last decade (+37%) with about 15,000 jobs.
- High growth in ZEV registrations, up 22 percent between 2011 and 2012 to 2,300.

CHARGING INTO THE FUTURE:



CALIFORNIA'S ENERGY STORAGE OPPORTUNITY

California blazed the trail for the energy storage market in 2013 with its landmark mandate for utilities to implement 1.3 gigawatts (GW) of energy storage by 2020. This mandate comes at a time when the electric industry is beginning an overall transformation as it adapts to new technologies, services, and power providers, all of which are playing key roles in the modern electric grid. This transformation ranges from smart grid and vehicle-to-grid services to power infrastructure upgrades, and an integral part of these changes is the role of on-grid and behind-the-meter energy storage.

The energy storage sector has been gaining momentum in recent years as the need for these technologies has increased. Given California's new mandate, along with other supportive state and international policies and an increasing demand from industrial, commercial, and residential consumers, the energy storage market is ripe for growth. California is poised to capitalize on this opportunity and keep the economic benefits of the mandate in the state. **This feature demonstrates why California is well positioned to lead the country and even the world in energy storage deployment, innovation, and economic activity.**

MARKET OPPORTUNITY

The energy storage market has tremendous opportunity to grow and provide a range of services to multiple customer types, but has only begun to scratch the surface on deployment. While California is leading the nation with the most capacity installed and the highest number of small and large projects (Table 14), it is still a largely untapped market.

TABLE 14. ENERGY STORAGE DEPLOYMENT IN TOP U.S. STATES

RANKING	STATE	TOTAL IN MW	TOTAL NUMBER OF SMALL PROJECTS (4 KW-1.5MW)	TOTAL NUMBER OF LARGE PROJECTS (>1.5MW)
1	CALIFORNIA	481.78	26	9
2	TEXAS	333.60	3	5
3	ALABAMA	110.00	0	1
4	ALASKA	56.00	1	3
5	WEST VIRGINIA	35.02	2	2
6	HAWAII	28.43	7	2
7	NEW YORK	20.36	6	3
8	PENNSYLVANIA	10.60	7	2
	U.S. TOTAL	1107.69	86	33

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There are a broad set of potential customers for implementing energy storage solutions, each facing different factors driving adoption. A few key market drivers are listed for the leading customer types below:

- **Private or business consumers,** including commercial, industrial, or residential customers, can use energy storage behind-the-meter to manage their on-site energy use. Energy storage can help consumers lower their electricity rates and peak demand charges because the storage application can be used during peak times. In addition, energy storage can be an emergency backup power source for the consumer.
- **Utilities,** including investor-owned and municipal utilities, could use storage to integrate intermittent renewable energy sources such as solar and wind energy, as well as optimize the grid by managing peak power needs. Energy storage can also help utilities to defer and/or avoid expensive infrastructure upgrades, and increase grid reliability.
- **Public government entities,** such as the state of California, play the dual role of potentially deploying energy storage technologies behind-the-meter at public facilities, as well as creating mandates and incentives to enable market transformation of the various energy storage technologies. In addition, public entities may have an interest in deploying energy storage to defer and/or avoid the need for new fossil-fuel plants to meet peak demand, which can reduce greenhouse gas emissions.

In California, these consumers have already started to implement energy storage solutions, which gives them a head start on other states in identifying and resolving potential early market barriers. Utilities, for example, are evaluating how best to add residential rooftop solar systems with batteries to the grid. This early market testing positions California to lead the nation in setting standards and installing storage solutions to capitalize on the market opportunity.

ECONOMIC ACTIVITY

INNOVATION

California is at the forefront of energy storage innovation, which is a critical market activity as energy storage technologies are developed and implemented. California's research institutions and the private sector are leveraging their strengths to help the state lead the way. CalCharge, for example, is a public-private partnership with members such as CalCEF, Lawrence Berkeley National Laboratory, Hitachi, and San Jose State University, that is working to accelerate the development, commercialization, and adoption of energy storage technologies. In 2013, San Jose State University and CalCharge launched a "Battery University" to train a specialty workforce for the sector.[22]

California leads the U.S. in energy storage patent innovations, which will help to position California's energy storage industry for future growth. Patents represent intellectual property that can be leveraged by startups, established companies and researchers to increase efficiency and cost effectiveness of technology and create new products. After averaging 60 patents annually between the early 1990s and 2008, patent registrations from California-based inventors soared in the subsequent five years to reach roughly 220 energy storage patents in 2013, quadrupling 2008 levels (Figure 42). California registered more energy storage patents in 2013 than the next four highest states combined. The majority of California's energy storage patents were registered to private firms, such as Tesla and Imergy Power Systems (formerly Deeya Energy), though academic and research institutions also played a significant role, such as the University of California, California Institute of Technology and Lawrence Livermore National Laboratory.

While California has very strong innovation assets and a growing base of energy storage economic activity, the international landscape for energy storage is extremely competitive. California represents the equivalent of the fourth highest country in the world with respect to its patent registrations, though Japan and South Korea far surpass its patenting levels, and China and Taiwan have ramped up research activity rapidly (Table 15).[23]

FIGURE 42. ENERGY STORAGE PATENT REGISTRATIONS IN TOP U.S. STATES

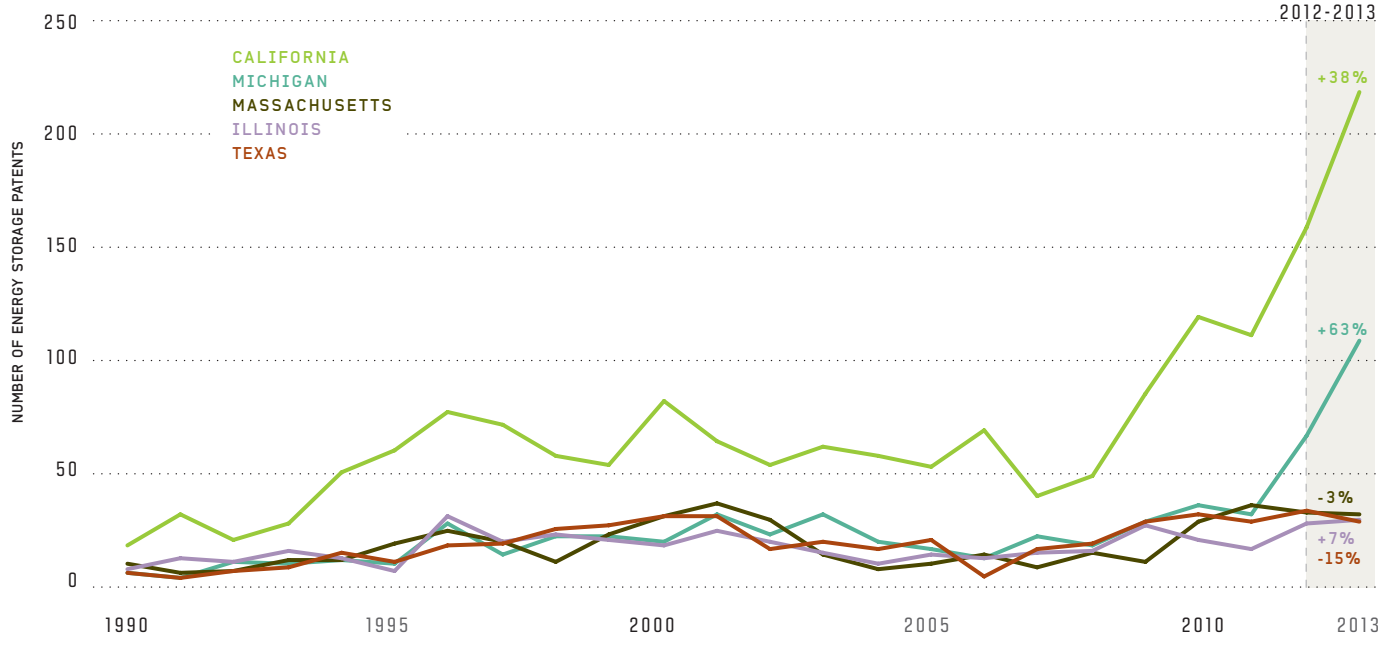

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TABLE 15. ENERGY STORAGE PATENT REGISTRATIONS IN REST OF U.S., CALIFORNIA, AND TOP COUNTRIES

	2012	2013
JAPAN	719	739
REST OF U.S.	510	619
SOUTH KOREA	239	408
CALIFORNIA	159	219
TAIWAN	93	103
CHINA	106	96

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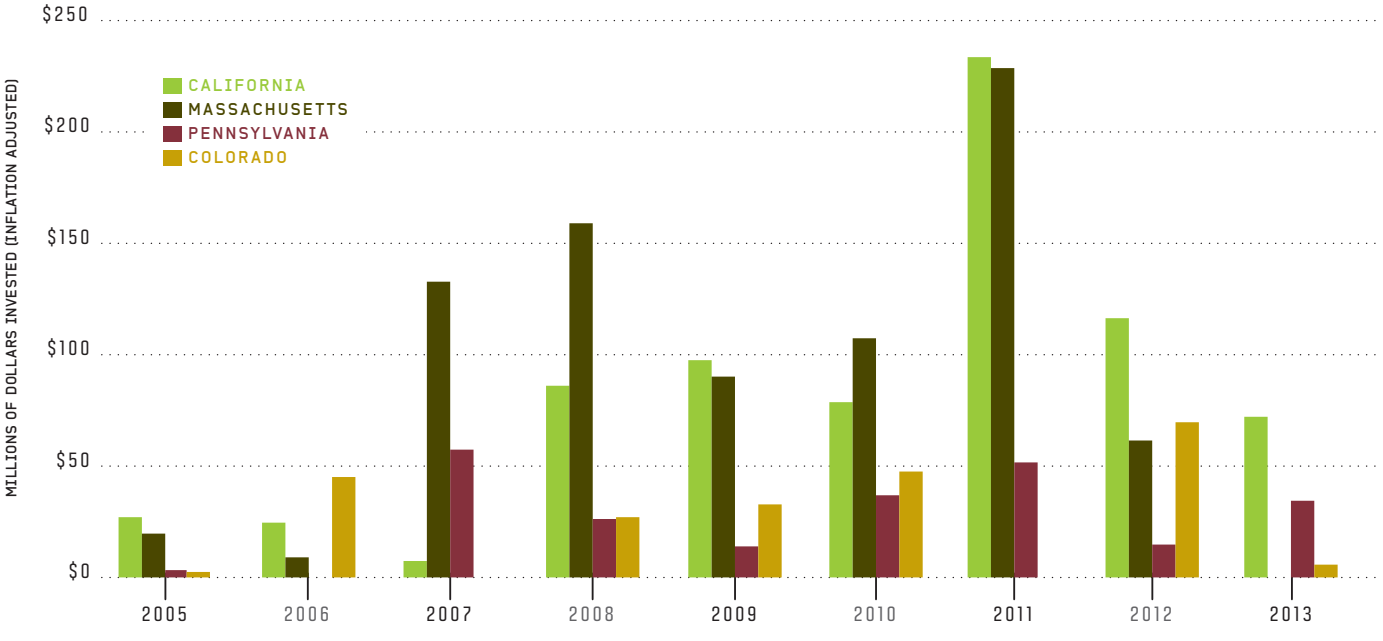
California has also led the U.S. in recent years in venture capital investment for energy storage companies, which is critical for allowing companies and researchers to develop and improve technologies. California energy storage startup companies received nearly $73 million in 2013, the most of any other state, though down 38 percent from 2012 following an overall venture capital decrease (Figure 43). California's recent investments suggest that investment activity may be increasing. For example, behind-the-meter storage company Stem received a $15 million Series B round in December 2013 and Primus Power raised a $20 million Series C round in early 2014. While Massachusetts surpassed California in the late 2000s, energy storage venture capital investment in the state dropped off in recent years, with no investment in 2013. Other states, such as Pennsylvania and Colorado are also notable recipients of venture capital for energy storage companies, though they remain behind California.

EMPLOYMENT

The energy storage market is diverse, ranging from small startup companies to large established corporations, performing activities from research & development to manufacturing and installation. This analysis focuses on the "core" energy storage sector, which includes companies that enable the transformation of the market, such as those companies developing storage technologies or implementing storage solutions for buildings and utilities. In addition to this core sector, there are a range of segments not included in these figures that leverage energy storage technology, such as Energy Infrastructure and Energy Generation, and benefit from growth in core energy storage. As of January 2012, California had over 2,500 jobs in the core energy storage sector, up eight percent from January 2011. Three-quarters of those jobs were focused on advanced batteries.

FIGURE 43. VENTURE CAPITAL INVESTMENT IN ENERGY STORAGE IN TOP U.S. STATES

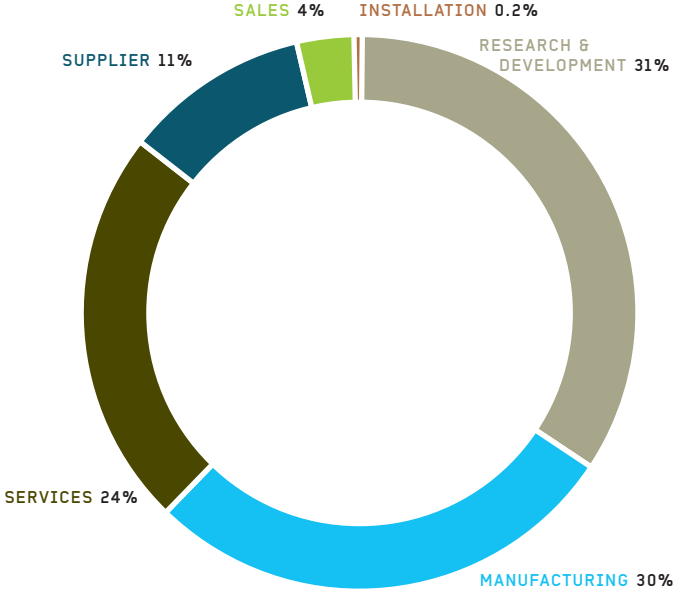


NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: CB Insights. Analysis: Collaborative Economics

These jobs are distributed across value chain activities, with about a third in research & development, 30 percent in manufacturing, and 24 percent in services. Given the early stage of the market, few companies were identified that did installation specifically, though this activity has the potential to grow as deployment increases (Figure 44).

In addition to the core energy storage companies, large corporations with diverse activities and utilities are key players in the energy storage market, though are not captured in the jobs analysis above. For example, large utilities such as Southern California Edison will be a large purchaser and implementer of energy storage systems in the next decade. Companies in related segments, such as SolarCity, Silver Spring Networks, and eMeter (now part of Siemens), will also be key implementers of energy storage solutions for a range of customers. Supportive organizations in the state, such as the California Energy Storage Alliance, can also play an important role in advancing the energy storage market by coordinating diverse interests and addressing market issues.

FIGURE 44. ENERGY STORAGE EMPLOYMENT BY VALUE CHAIN CALIFORNIA, 2012



TOTAL ENERGY STORAGE EMPLOYMENT = 2549 JOBS

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: Green Establishments Database. Analysis: Collaborative Economics

ENERGY STORAGE TECHNOLOGY: BEHIND-THE-METER & ON-GRID

The energy storage sector includes a range of technologies that allow you to use energy at a later time than when it was generated, such as batteries, flywheels, thermal chemical systems, compressed air, pumped hydro, superconducting magnetic energy storage, electrochemical capacitors and sometimes fuel cells. Each technology has unique characteristics that make it suited for various applications. For example, flywheels offer a means of regulating grid frequency for shorter discharge times and can be installed with few geographic constraints, while compressed air energy storage has specific geographic requirements and can support high levels of renewable energy penetration and grid stability.[32]

This analysis groups energy storage applications or "domains" into two main categories, "on-grid" and "behind-the-meter." Some technologies may be used in both domains, while others are specially suited to one. "On-grid" refers to distribution — or transmission — connected storage, and typically involves larger scale energy storage projects, which serve to smooth power variations within the electricity grid during periods of intermittency or high demand. As intermittent renewable energy capacity (namely wind and solar) increases, these on-grid storage systems will serve an important modulating and stabilizing function. "Behind-the-meter" energy storage focuses on customer-sited energy storage and serves a dual function of lowering customer demand to reduce peak load for the grid, as well as decreasing energy bills for commercial and industrial customers.

CAPTURING THE OPPORTUNITY IN CALIFORNIA: POLICY AND ACTION

Public policies are a key factor positioning California as a leader in developing and deploying energy storage technology. California has adopted a number of forward-looking laws and programs to incentivize adoption of energy storage technology, such as AB 2514, which passed in 2010 and required the California Public Utilities Commission (CPUC) to define grid-scale energy storage procurement targets and policies.[24] In addition, the Self Generation Incentive Program, established in 2001 and expanded to energy storage in 2011, provides performance-based incentive payments for up to 60 percent of project costs on various distributed energy technologies.[25] California's most significant policy to date occurred in late 2013, when the CPUC, complying with AB 2514, established a mandate directing investor-owned utilities to procure 1.3 GW of energy storage capacity by 2020 and for Electric Service Providers and Community Choice Aggregators to procure energy storage equal to one percent of their annual 2020 peak load by 2020 (CPUC Decision 13-10-040).[26] This mandate is the first of its kind in the U.S.,[27] and represents a significant market growth opportunity for a range of on-grid and behind-the-meter energy technology companies.

While setting an ambitious pace, California is not alone in its efforts to promote energy storage deployment and development. For example, in addition to California's electricity transmission monitoring and control organization (California's Independent Systems Operator), three other regions in the U.S. have adopted federal guidelines around energy storage integration for frequency regulation and payment structures (FERC 755), including the Midcontinent Regional Transmission Organization and the New York Independent System Operator. New York has implemented other leading policies and programs as well, including incentives for energy storage systems designed to reduce peak electricity load, and a $23 million public-private investment in a battery research and commercialization center.[28] Texas is another early mover in the energy storage market; though the state is not offering financial incentives for energy storage, the Public Utilities Commission of Texas has been working to clarify interconnection processes and rates for energy storage projects, as well as streamline regulations to facilitate deployment.[29] On the international stage, multiple countries initiated policies and programs in 2013. Germany established a 25 million energy storage incentive program to encourage adoption of distribution-connected and behind-the-meter storage capacity,[30] and Japan initiated a $300 million grant program to encourage deployment of on-grid capacity.[31] While these emerging policies targeting deployment offer a market opportunity for California companies, they will also provide stimulus for competitor companies in the respective markets, increasing competition and encouraging product and business model innovation in energy storage.

While there is notable policy progress and growing opportunities in energy storage, given the early stage of this sector there are still key market barriers to address as well. The U.S. Department of Energy, for example, identified four main barriers to explore to promote the widespread deployment of grid energy storage: cost competitiveness of energy storage systems; validated performance and safety; equitable regulatory environment; and industry acceptance.[32]

California's forward-looking policies, strong research & development activities, and business growth have helped it gain a strong foothold in the national and global forefront. California is well positioned to capitalize on the energy storage market opportunity, and will need to continue its proactive approach and innovative activities to remain a key player in this rapidly changing market.

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7

ELECTRICITY CONSUMPTION, 2012

	TOTAL REVENUE FROM ELECTRICITY SALES (MILLION DOLLARS, INFLATION ADJUSTED)	2012 GDP (MILLIONS OF DOLLARS, INFLATION ADJUSTED)	SALES AS A FRACTION OF GDP
CALIFORNIA	$36,083.25	$2,032,825	1.78%
TEXAS	$31,891.21	$1,417,837	2.25%
DIFFERENCE			0.47% points
DIFFERENCE IN DOLLARS	$2,032,825* 0.47% = $9.5 billion		

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APPENDIX

GENERAL REFERENCES

Inflation Adjustment

Inflation-adjusted figures are converted into 2013 dollars using the U.S. city average Consumer Price Index (CPI) of all urban consumers, published by the Bureau of Labor Statistics.

Gross Domestic Product

Nominal gross domestic product (GDP) data for California, states and the nation are sourced from the Bureau of Economic Analysis, U.S. Department of Commerce. Real GDP figures are nominal GDP data converted into 2013 dollars, as specified in Inflation Adjustment.

Population

California population data used to calculate per capita figures are from the California Department of Finance's "E-4 Population Estimates for Cities, Counties and the State, with 2000 and 2010 Census Counts." National, state and "U.S. without California" population data are from the U.S. Census Bureau, Population Estimates Branch.

THE CARBON ECONOMY

Global Fossil Fuel Combustion and Carbon Economy in California and Other Regions

For the U.S. overall and other countries, data for carbon dioxide emissions from the consumption of energy are from U.S. Department of Energy, Energy Information Administration (EIA), International Energy Statistics. State level emissions data come from EIA's State CO_2 Emissions. Calculations used GDP and Population data where applicable, as described above.

GHG Emissions and Gross Domestic Product, Total California Greenhouse Emissions, Emissions by Source, Emissions by Detailed Source

Greenhouse gas (GHG) emissions data for these figures are from the California Air Resources Board's "California Greenhouse Gas Inventory – by Sector and Activity" (April 2014). The 1990-1999 emissions include "gross emissions" and the 2000-2012 emissions are "included emissions" only. Note that "excluded emission" are not in these figures. Excluded emissions are transportation emission such as interstate and international aviation and international marine, and military emissions. Calculations used GDP and Population data where applicable, as described above.

ENERGY EFFICIENCY

Energy Productivity, Energy Consumption Relative to 1970, Primary Energy Consumption by Source and Sector

Energy data used in both analyses are from the U.S. Department of Energy, EIA, State Energy Data System, Consumption Estimates, 1960-2011. Data is for total energy consumption, in British Thermal Units (BTU). Energy productivity divides GDP by total energy consumption. Energy consumption creates a gross and per capita index, where 1970=100. Data for primary energy consumption uses Tables C4-C9 and is in trillion BTUs. Primary energy is in the form that it is first accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy (for example, coal is used to generate electricity). Calculations used GDP and Population data where applicable, as described above.

Electricity Consumption Relative to 1990, Statewide Electricity Bill as a Percent of GDP

Electricity consumption and pricing data are from the U.S. Department of Energy, EIA, Current and Historical Monthly Retail Sales, Revenues and Average Retail Price per Kilowatt-hour by State and by Sector (Form EIA-826), and includes the amount of electricity sold to end users (excludes self-generation). Electricity consumption calculates the gross and per capita index, where 1990=100. Electricity Bill Percent of GDP multiplies monthly retail sales and prices (by sector), aggregates by year and then divides by GDP.

Electricity Consumption by Sector

Electricity consumption data are from the California Energy Commission's California Energy Consumption Data Management System: Electricity Consumption by Entity. Data includes all utility types.

Electricity Bill by Sector

Data to calculate electricity bills by sector are from 1990 – 2012 use Retail Sales of Electricity by State by Sector Provider (EIA-861) and 1990 - 2012 Average Price by State by Provider (EIA-861), published by the U.S. Department of Energy, EIA. All figures are inflation-adjusted.

RENEWABLE ENERGY

Renewable Energy Generation

California renewable energy data is from the California Energy Commission, "Net System Power Reports" 2002-2012, Total System Power in Gigawatt Hours (GWh). U.S. total electricity generation data is from the U.S. Department of Energy, EIA, Electric Power Monthly reports. Annual totals from "Table 1.1 Net Generation by Energy Source: Total (All Sectors)," and "Table 1.1.A. Net Generation by Other Renewables: Total (All Sectors)." Because of different renewable energy definitions between California and the U.S., data represented for the U.S. do not include any hydro.

Renewable Portfolio Standard Cumulative Operational Capacity

Data are from the California Public Utilities Commission "RPS Project Status Table 2014 Jan" released on January 2, 2014. Projects include those Approved and Online, Approved in Development, Delayed but likely to be completed per CPUC, and those in the Renewable Auction Mechanism and Investor-Owned Utility Solar Photovoltaic programs. Projects are classified as operational, online, in progress, and on schedule. Years are based on the online date/contracted delivery date, though those with a status of in progress, delayed, or on schedule (i.e. not classified as online) with pre-2014 dates were labeled as 2014.

New Solar Installations, New Solar Installations by Sector

Solar capacity installed data are provided by Solar Energy Industries Association® (SEIA) and GTM Research and the California Solar Initiative SEIA data were taken from the U.S. Solar Market Insight Reports, 2007-2013, and includes California Solar Initiative (CSI), municipal utility, and other utility-scale installations. CSI data for this indicator include all completed projects (across all sectors) from January 2007 through December 31, 2013, and the year is based on First Incentive Claim Request Review Date.

Wind Installations

Wind capacity installed and cumulative data are provided by the American Wind Energy Association. Data is taken from quarterly and annual U.S. Wind Industry Market Reports, 2006-2013.

CLEAN TECHNOLOGY INNOVATION

Investment in Clean Technology, all figures

Clean technology investment data are provided by CB Insights™ (www.cbinsights.com) and includes disclosed investment deals in private companies. Data is through December 2013. Data for global clean technology venture capital (VC) investment is provided by Cleantech Group™ (www.cleantech.com). All figures were adjusted for inflation, as described above.

VC data includes Angel, Seed, Series A-E+, Growth Equity, Bridge, and Incubator series types. "Other" type of investment includes PIPE, private equity, angel, convertible notes, corporate minority, unattributed, other, and partnership. Debt includes loan guarantees from the federal government, as well as credit and loans from private investors such as banks, investment funds, and financial services groups. Grants include grants from federal and state government agencies. VC with Corporate Involvement data includes VC deals with investor types listed as Corporate Venture or Corporation. Other non-VC corporate investments such as partnerships are not included in Corporate VC data. Totals may not be the same across charts because of different investment types included.

Regions are divided as follows - San Diego: San Diego and Imperial Counties; Los Angeles: Los Angeles and Ventura Counties; Orange County: only Orange County; San Francisco: Alameda, Contra Costa, Marin, Napa, San Francisco, and Solano Counties; Silicon Valley: Santa Clara and San Mateo Counties, and Scotts Valley, Fremont, Newark, and Union City.

Clean Technology Patents, all figures, including those for the Energy Storage Feature

1790 Analytics developed and performed the search of U.S. Patent data from the U.S. Patent & Trade Office based on search criteria defined in conjunction with Collaborative Economics. The "Two or More" category refers to patents that fall into multiple clean technology areas, and are therefore distinguished separately in aggregate patent analysis to avoid double counting. Analysis of individual clean technology patent categories includes all patents meeting the category definition. Energy storage technology includes Batteries, Flywheels, Electrochemical Capacitors and Thermal, Superconducting Magnetic and Compressed Air Energy Storage; excludes fuel cells and pumped hydro.

TRANSPORTATION

GHG Emissions from Surface Transportation and Vehicle Miles Traveled

GHG emissions data are from the California Air Resources Board's "California Greenhouse Gas Inventory – by Sector and Activity." Surface Transportation emissions sources include passenger vehicles, motorcycles and light and heavy duty trucks. Vehicle Miles Traveled (VMT) is defined as total distance traveled by all vehicles during a selected time period in geographic segment. VMT estimates for 1995-2007 are from the California Department of Transportation's "2008 California Motor Vehicle Stock, Travel and Fuel Forecast." VMT data for 2008-2012 are from the California Department of Transportation's Highway Performance Monitoring System's "California Public Road Data." Calculations use Population data sources where applicable.

Vehicle Registrations

Data are from the California Energy Commission (CEC), compiled using vehicle registration data by fuel type from the California Department of Motor Vehicles. Alternative fuel-types include all hybrid (gasoline and diesel), electric, plug-in hybrid, hydrogen, propane, and natural gas. Zero emission fuel-types include electric, plug-in hybrid, and hydrogen.

GREEN ESTABLISHMENT DATABASE

Collaborative Economics has developed an approach for identifying and tracking the growth of businesses with primary activities in the Core Clean Economy. This methodology was originally developed for work carried out on behalf of Next 10, a California-based nonprofit, and published in the *California Green Innovation Index* and *Many Shades of Green* (2008, 2009, 2010, 2012, 2013).

The accounting of green business establishments and jobs is based on standard industrial classification (SIC) codes and multiple sources (including Bloomberg New Energy Finance, CB Insights, and the Cleantech GroupTM LLC) for the identification and classification of green businesses, and also leverages a sophisticated internet search process. The National Establishments Time-Series (NETS) database, based on Dun & Bradstreet business-unit data, was sourced to extract business information such as jobs. The jobs numbers reported in the database reflect all jobs at each business location. In the case of multi-establishment companies, only the green establishments are included.

The multilayered process involves both automated and manual verification steps of business establishments and their activities. In cases where the results were uncertain and the activities of a business establishment could not be verified (e.g. on a company's website), the establishment was dropped from the database. Therefore, the analysis offers a conservative tracking of jobs in the Core Clean Economy.

ENERGY STORAGE DEPLOYMENT

Energy storage data are from the U.S. Department of Energy's Global Energy Storage Database as of February 28, 2014. Data includes only those projects listed as verified. Status of projects includes: announced, contracted, operational, and under construction. Technology type category includes: battery, flywheel, thermal, and compressed air. Pumped hydro was not included because large-scale pumped hydro projects are not eligible for the CPUC mandate.

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California Department of Transportation	U.S. Census Bureau
California Energy Commission	U.S. Patent and Trademark Office
California Public Utilities Commission	Walls & Associates

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